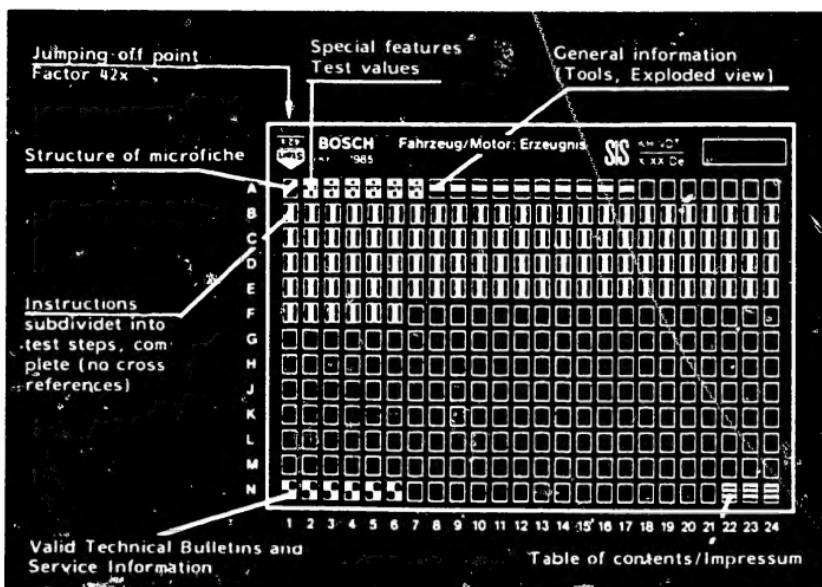
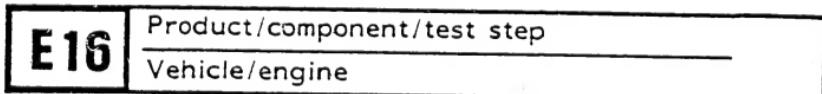


# Structure of microfiche



1. Read from left to right
2. Title of microfiche (appears on each coordinate)



Coordinate

3. Limits of section



4. References to relevant test steps in test specifications; coordinate e.g. C6



A1

Trouble-shooting program



## 1. Special features

Repair instructions for in-line injection pumps of series PE(S) ..P..1,..P..1000,..P..3000,..P..6000,..P..7000 and PES V..P 6 and 8-cyl. without governor, manifold-pressure compensator and timing device. Dismantling of the various governor types is performed in accordance with the respective repair instructions.

## 2. Test specifications

2.1 Projection dimension of camshaft  
approx. 3 mm

**D 11**

2.1 Projection dimension between  
measuring strip and pump  
housing specification  $13.8 \pm 0.5$  mm

**D 13**

2.2 Axial clearance of camshaft

Setting value:

Tapered-roller bearing: 0.02 - 0.06 mm

**D 17**

Checking value:

Tapered-roller bearing: 0.01 - 0.07 mm

2.3 Leak test (suction gallery)

Test time and test pressure 8 min. at  
5 bar, then 1 min. pulsating 0 to 5 bar

**E 12**

2.4 Installing the tappet holder KDEP 1041  
(pump ..S1/S800/S1000) installation

dimension 63.0 mm

**E23**

(pump .. S 3000/S6000) installation

dimension 64.2 mm

**E24**

(pump .. S 7000) installation

dimension 65.00 mm

**A2**

Special features/Test specifications

P-pump 0 410 ..



**F6**

## 2.5 Leak test (camshaft chamber)

Test time and test pressure  
7 min at 1.5 bar, then  
1 min at 0.5 bar

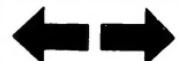
## 2.6 Tightening torques

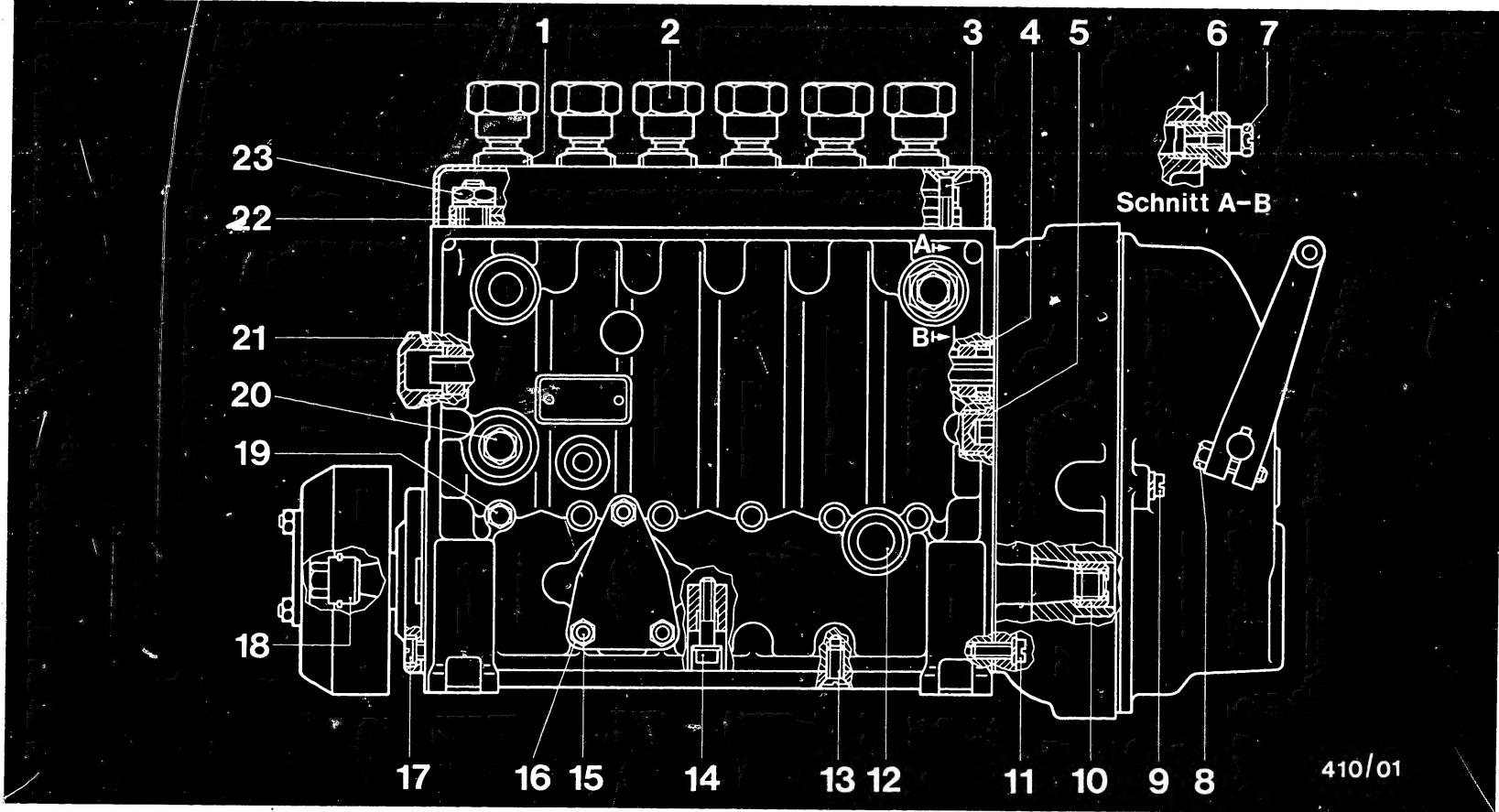
The following Coordinates A4/5 itemize screws,  
nuts etc. on the drawing.

The items are repeated on the right in the list, and  
they are accompanied by the Coordinates on which you  
can find the tightening torque.

**A3**

Test specifications  
P-pump 0 410 ..





Item	Coordinate
1 ... 13	A 6
14... 23	A 7

Schnitt A-B = Section A-B

**A4**

Test specifications  
P-pump 0 410 ..



**A5**

Test specifications  
P-pump 0 410 ..



## Tightening torques

Item No.	Description	Nm
1	Delivery-valve holder PE(S) ..P.../.. M 26 x 1.5	65 - 80
	PE(S) ..P...A.. M 26 x 1.5	80 - 90
	PE(S) ..P...S6000 M 22 x 1.5	110 - 120
2	Union nut	max. 25
3	Flat-head screw	2 - 3
4	Control-rod guide bushing	30 - 40
5	Screw plug	40 - 50
6	Threaded bushing	20 - 30
7	Bleeder screw	4 - 5
8	Control-lever fastening screw	8 - 9
9	Governor-cover fastening screw	5 - 7
10	Mechanical governor M 12 *	50 - 60
		** 65 - 75
11	Governor fastening screw for hexagon screws	6 - 8
	for fillister-head screws	7 - 9
12	Fitting M16 x 1.5	30 - 35
13	Base cover fastening screws	6 - 7

\* Flyweight assemblies with lubrication coil and bore on driver, and without bore in universal joint.

\*\* Flyweight assemblies without lubrication coil and bore on driver, and with 2 bores in universal joint.



## Tightening torques (continued)

Item No.	Description	Nm
14	Hexagon-socket-head cap screw/ fillister-head screw for intermediate bearing	7 - 9
15	Threaded pin	3.5 - 4.5
16	Hexagon nut	7 - 9
17	Bearing end plate fastening screws	7 - 9
18	Timing device Cone diameter 17 mm M 12 20 mm M 14 x 1.5 25 mm M 18 x 1.5	60 - 70 85 - 100 100 - 110
	Couplings Cone diameter 20 mm M 14 x 1.5 25 mm M 18 x 1.5 30 mm M 20 x 1.5	65 - 75 100 - 110 150 - 170
19	Screw plug	8 - 10
20	Screw plug	40 - 60
21	Closure cap	40 - 60
22	Headless setscrew	25 - 30
23	Hexagon nut	40 - 45

A7

Test specifications

P-pump 0 410 ..



## General information

### Cleaning the parts

Wash the parts in low-inflammability, commercially available cleaning agent, e.g. Chlorothene NU.  
Then blow off with compressed air.

### Observe the following safety regulations.

Decree on Working With Combustible Liquids (Vbf) Issued by the Federal Ministry of Labor (BmA).

Safety rules for handling chlorinated hydrocarbons  
for the workshop ZH 1/222  
for the employee ZH 1/119  
issued by the Central Association of German Employers'  
Liability Insurance Associations (Central Association  
for Accident Prevention and Industrial Medicine)  
Langwartweg 103, D-5300 Bonn 5.

In countries outside the Federal Republic of Germany,  
observe the corresponding local regulations.

#### Notes:

These repair instructions contain the complete repair procedure for in-line pumps of size "P" except series "S7100 and S7800".

The various versions of in-line pump should be taken from the respective service-parts lists.



Worn and damaged parts must be discarded.

Sealing elements and camshaft bearing must always be renewed.

Injection-pump components which are stored for a lengthy time should be covered and protected against rust.

Radial-lip-type oil seal

Oil lightly

Plunger-and-barrel assemblies  
and delivery valves

Wash in cleaning  
agent, wet plungers  
with calibrating  
oil.

Seal rings

Rub with tallow



#### 4. Tools and fixtures

Description	Part No.	Use
Clamping support with clamping parts for cradle mounting	KDEP 2919 KDEP 2919/2	Mounting the injection pump
Clamping device	KDEP 2985	Clamping device for base mounting
1 set of intermediate pieces	KDEP 2985/4	for pumps ..S800 and S3800 with cradle mounting
Support clamp	KDEP 2963	Pumps with flange mounting
Overlong shaft	KDEP 2919/1/13	Used for 10 and 12 cyl. injection pumps
Assembly tool for timing device	KDEP 2944	Removing and mounting timing device EP/SP (Z) with cone 20 mm dia.
Socket pin wrench	KDEP 2944/1	
Socket wrench	KDEP 2944/0	
Extractor mandrel	KDEP 2944/2	
Holding wrench Slot width 10 mm	KDEP 2906	Holding the cam-shaft/turning the camshaft
Holding wrench Slot width 12 mm	KDEP 2885	
Tappet holder	KDEP 1041	Pump with tapped hole in housing
	KDEP 2910	Pump without tapped through hole in housing



Description	Part No.	Use
Puller	KDEP 2918	Pulling off the drive coupling cone dia. 20 mm
Puller	KDEP 2916	cone dia. 25 mm
Puller	KDEP 2911	Pulling off the barrel-and-valve assys
Puller	KDEP 1557	Pulling off drive coupling on pumps ..S800 + S3800
Clamping device	KDEP 1005	Mounting injection pump PESV
Holding bracket	KDEP 1505/1	Mounting assembly device KDEP 1505
Press-in mandrel	KDEP 1574	Installing the base end covers
Assembly device	KDEP 1505 or: KDEP 1067 (KDEP 2888)	Pressing down the roller tappets
Socket pin wrench	KDEP 2970	Removing and installing threaded bushings on control rod on 10 and 12 cyl. injection pumps
Socket pin wrench	KDEP 1003	
Puller 1 set of sleeves	KDEP 2911 KDEP 2911/2/1	Pulling off the barrel-and-valve assys

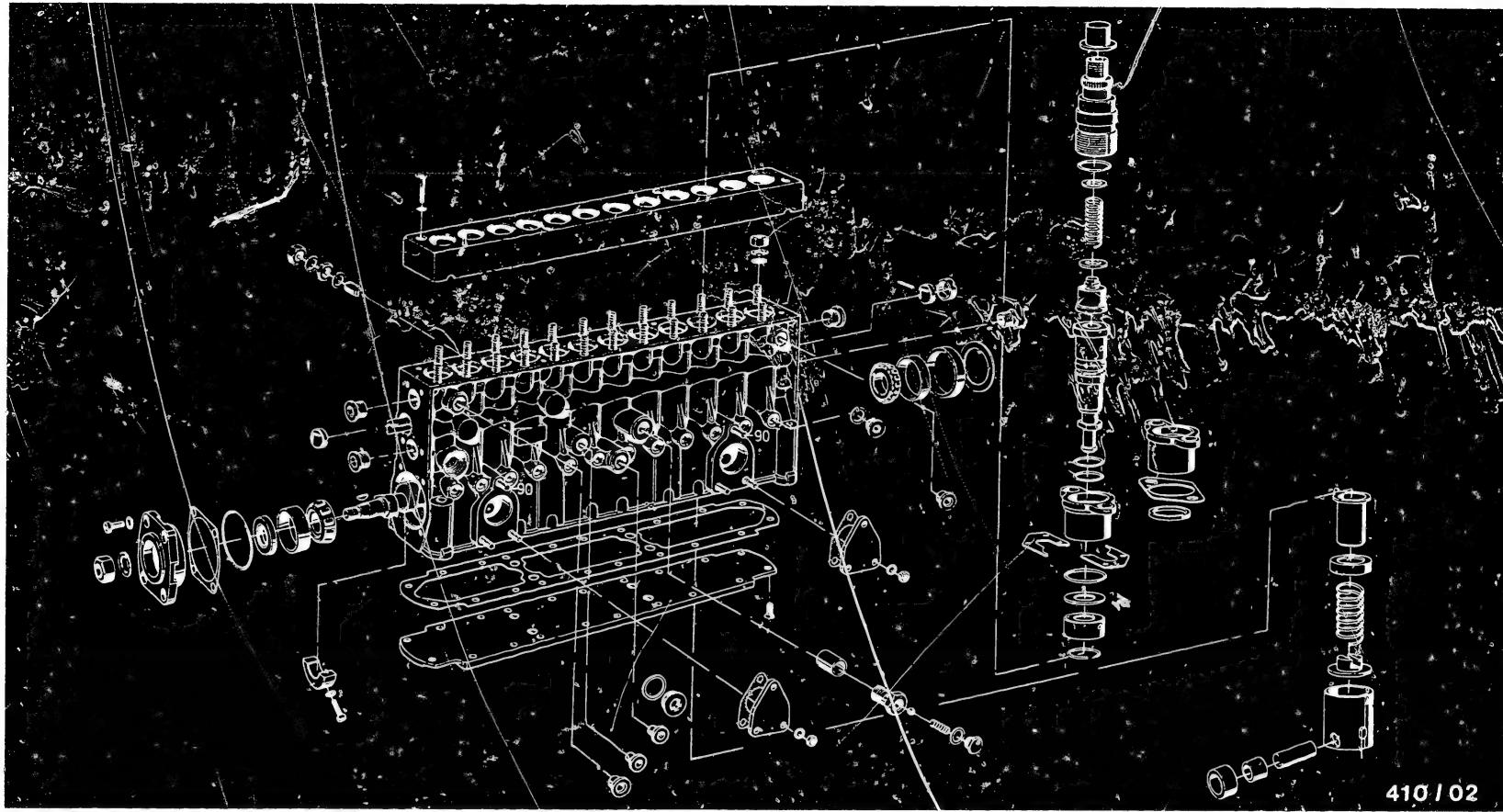


Description	Part No.	Use
Assembly device	KDEP 2962	Mounting barrel-and-valve assy
Socket wrench	KDEP 2986	Loosening delivery-valve holders
Mounting sleeve	KDEP 1046	Assembly device for barrel-and-valve assy
Measuring strip with cone 20 mm dia. 25 and 35 mm dia.	KDEP 2899 KDEP 2971	Measuring camshaft projection
30 mm dia.	KDEP 2924	
Insertion device	KDEP 2884	Insertion device for O-ring
Piston pliers	KDEP 2943	Introducing the pump plungers
Box wrench	KDEP 2997	For turning plunger-and-barrel assys
Forcing plate	KDEP 1580	Forcing off tapered-roller bearings
Press-on sleeve	KDEP 1583	Pressing on cam-shaft bearing 25 and 30 mm cone dia.
Press-on sleeve	KDEP 1582	Pressing on cam-shaft bearing 17 and 20 mm cone dia.
Insertion device	KDEP 1071	Inserting the control sleeve



Description	Part No.	Use
Mounting sleeve dia. 17 mm	KDEP 2874	Mounting the bearing end plate
Mounting sleeve dia. 20 mm	KDEP 2876	
Mounting sleeve dia. 25 mm	KDEP 2925	
Mounting sleeve dia. 30 mm	KDEP 1548	
Axial measuring tool cone dia. 20 mm	KDEP 2926	Measuring the camshaft axial clearance
cone dia. 25 mm	KDEP 2967	
cone dia. 30 mm	KDEP 2882	
Dial indicator for axial measuring tool	1 687 233 011	
Socket pin wrench Pin width 4 mm	KDEP 2986	Loosening and tightening round nuts on governor parts and timing devices
Pin width 6 mm	KDEP 2969	
Puller	KDEP 2886	Pulling off the drive coupling on automatic timing devices, fly-weights and gears
Puller	KDEP 2872	
Drive coupling 30 mm dia., long version	1 686 430 012	
Tool board	KDAW-T-100	Pulling off ball bearing outer races on bearing end plates
Clamping flange	1 687 000 065	Clamping device for MAN pumps
Holding mandrel	KDEP 1560 KDEP 1561	Leak test on suction gallery
Oil-tallow mixture, 50 g can	5 963 340 105	Threads on delivery-valve holder





5. Exploded views

5.1 In-line injection pump with flange bushing, 0 410 .. (PE(S)...P...)

A14

Exploded view

P-pump 0 410 ..

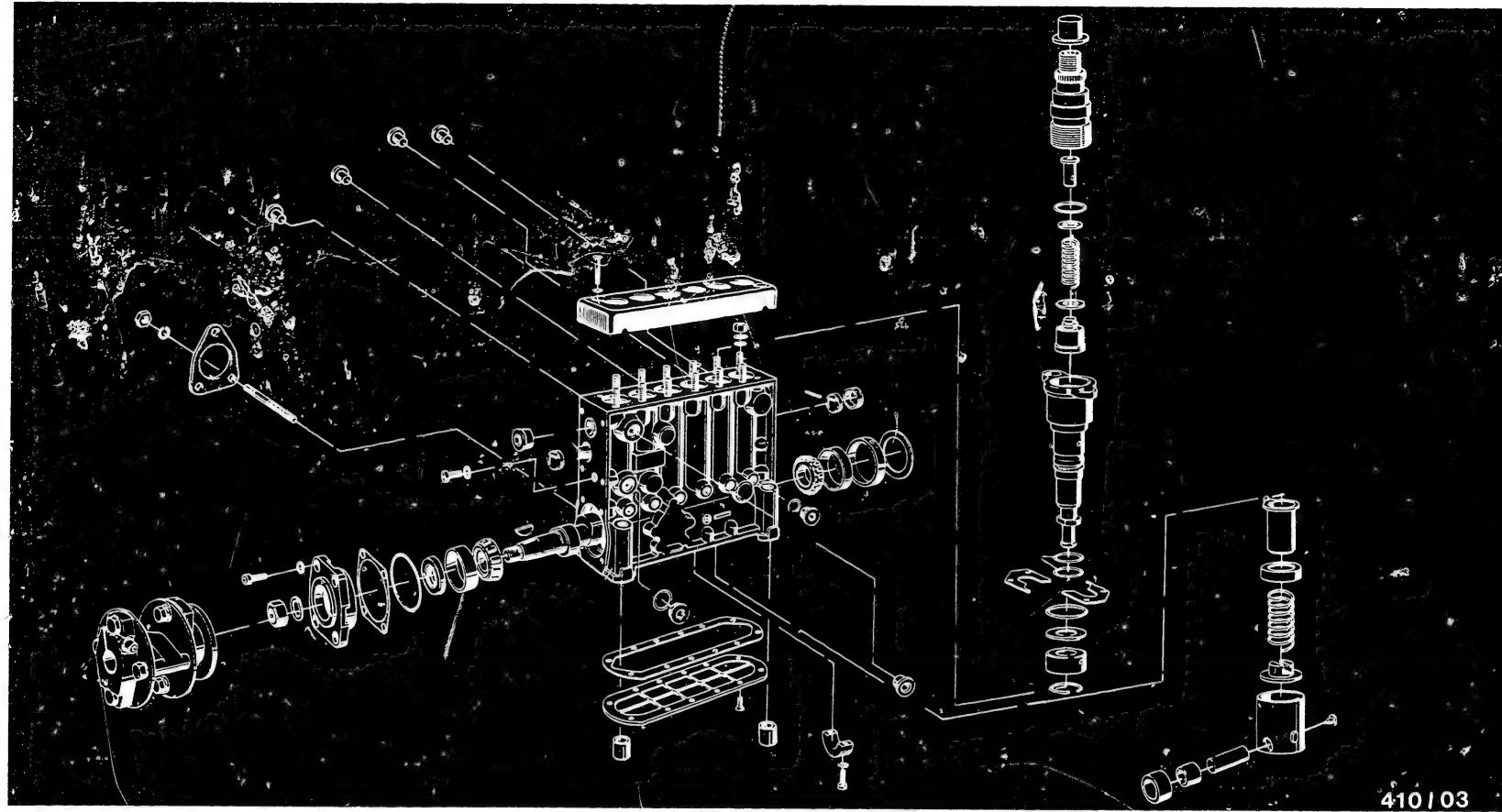


A15

Exploded view

P-pump 0 410 ..

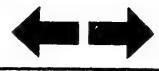




5.2 In-line injection pump with flange-type plunger-and-barrel assembly, 0 410 .. (PE(S)..P..)

A16

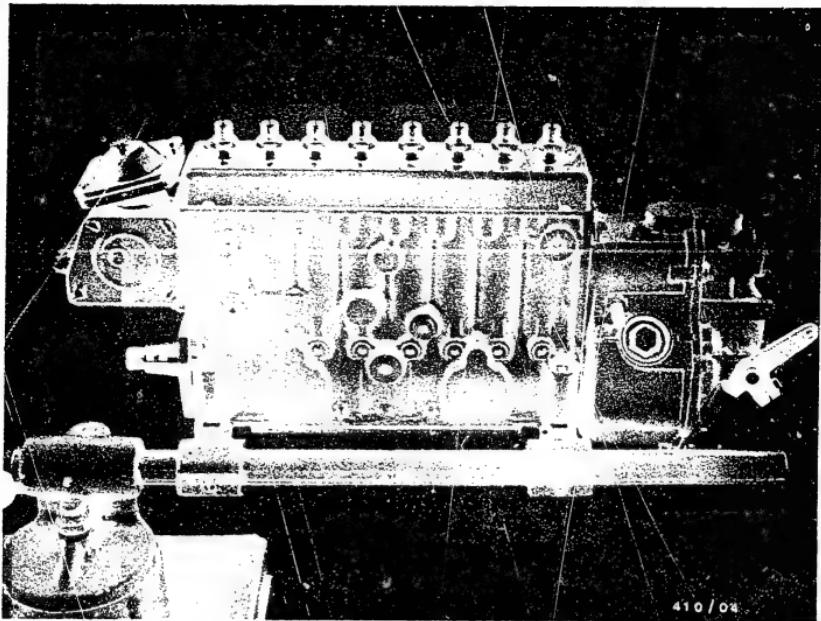
Exploded view  
P-Pump 0 410 ..



A17

Exploded view  
P-pump 0 410 ..





410 / 04

#### 6. Dismantling the injection pump (without mechanical governor)

Mount in-line injection pump PE..P.. with base mounting on rotatable clamping support KDEP 2919 in conjunction with clamping device KDEP 2985 (picture).

Clamping parts KDEP 2919/2 are required for injection pumps with cradle mounting. Device KDEP 2985 with intermediate pieces KDEP 2985/4 is intended for pumps of series ..S800 and ..S3800.

The overlong shaft KDEP 2919/1/13 must be used for 10 and 12 cylinder injection pumps.

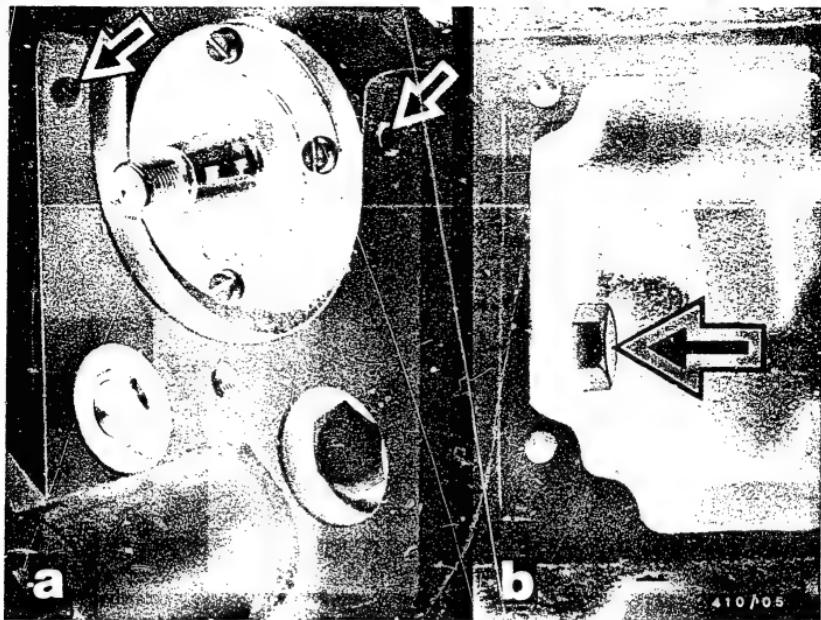
Support clamp KDEP 2963 with appropriate fastening flanges is required for pumps with flange mounting.

**B2**

Dismantling the injection pump

P-pump 0 410 ..





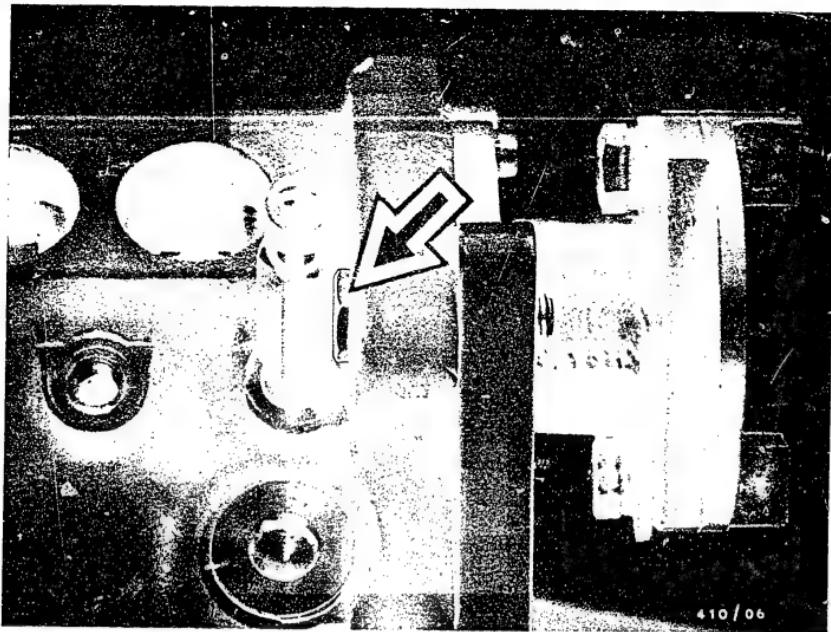
410/05

### Dismantling the PESV pump

Mount the injection pump on rotatable clamping support KDEP 2919 with clamping device KDEP 1005 (picture a).

Remove closing cover in the "V" of the pump (already removed in picture b).

Mount injection pump on clamping device by means of upper (arrow, picture b) and both lateral mounting holes (arrows, picture a).

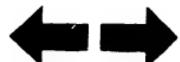


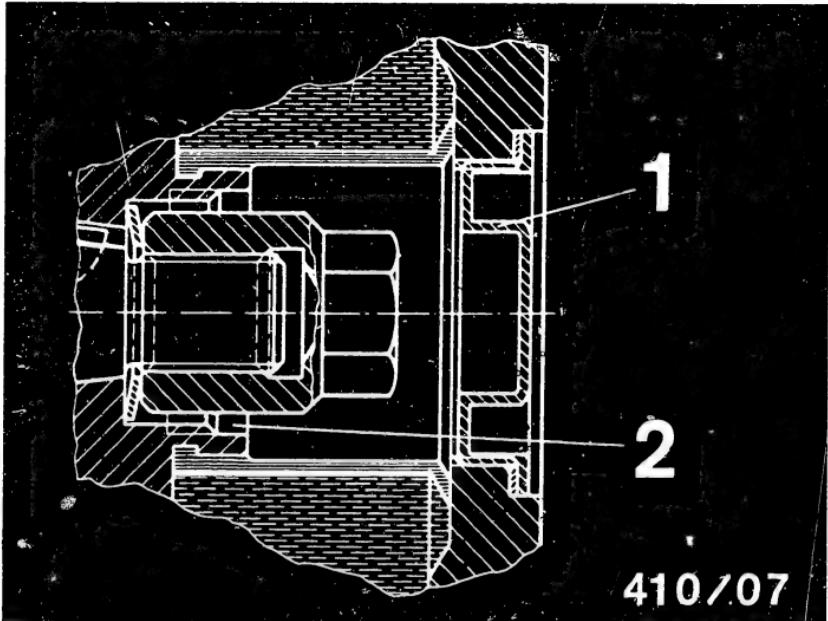
Note:

Shorten the screw head of one of the two lateral fastening screws so that the tappet holder can be inserted later (see picture, arrow).

**B4**

Dismantling the injection pump  
P-pump 0 410 ..





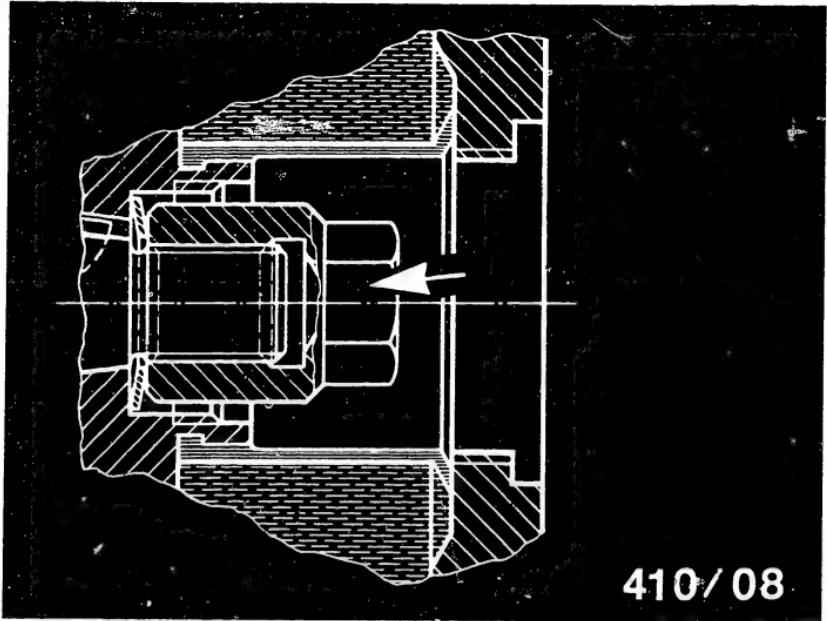
1 = Screw plug

2 = Recess for socket pin wrench

#### 6.1 Removing the timing device

Unscrew screw plug (see picture, arrow). Catch any escaping oil.

Introduce socket pin wrench KDEP 2944/1 from assembly tool set KDEP 2944 so that the two pins engage the recesses in the hub of the timing device.



410/08

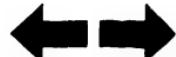
Introduce socket wrench KDEP 2944/0/1 into socket pin wrench.

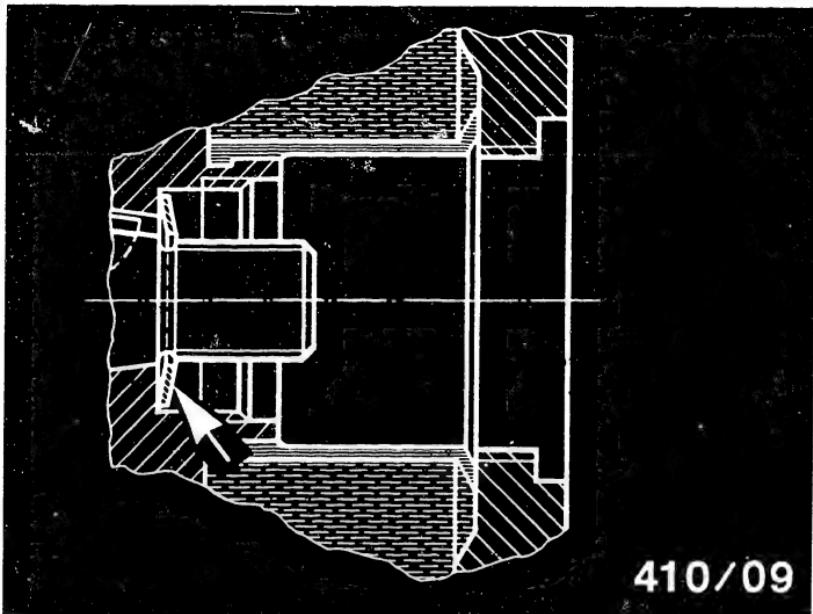
Loosen fastening nut (see picture, arrow) while holding with socket pin wrench and unscrew.

**B6**

Dismantling the injection pump

P-pump 0 410 ..



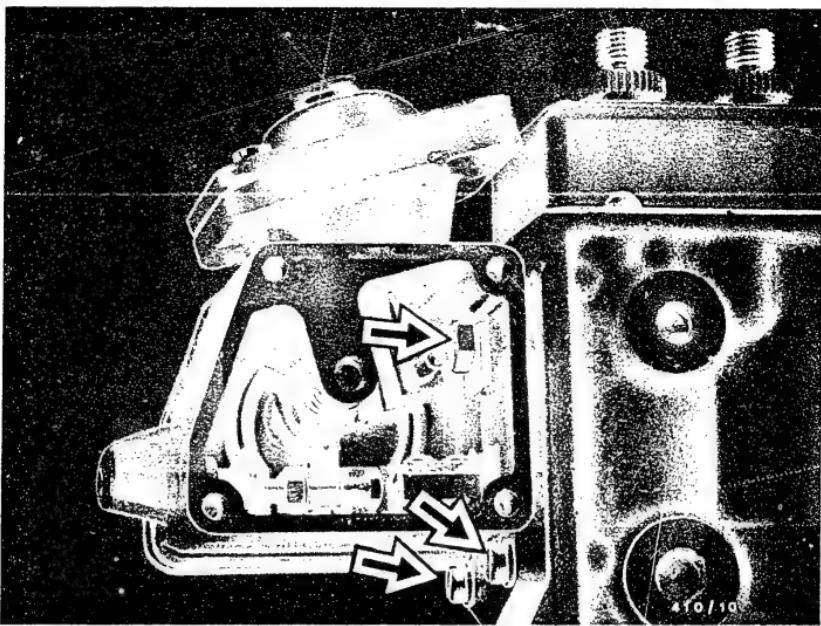


1 = Locking gasket

Screw extractor mandrel KDEP 2944/2 into hub of timing device.

By tightening securely while at the same time holding with the socket pin wrench, force the timing device off the cone of the camshaft.

Remove locking gasket (see picture, arrow).



## 6.2 Removing the manifold-pressure compensator

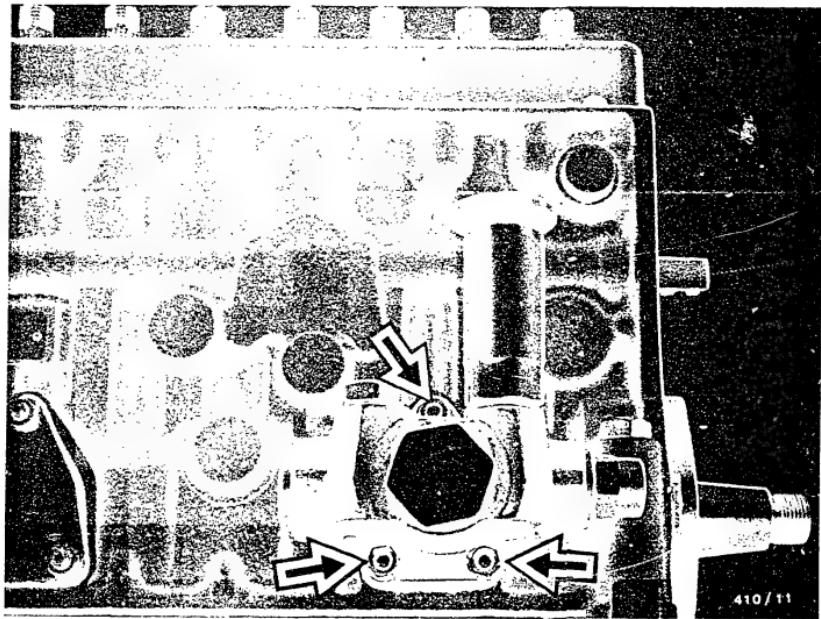
Unscrew closing cover from manifold-pressure compensator (already removed in the picture).

Remove fastening screws (see picture, arrows).

Take off manifold-pressure compensator.

### Note:

Remove and dismantle the governor in accordance with the respective repair instructions.

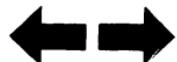


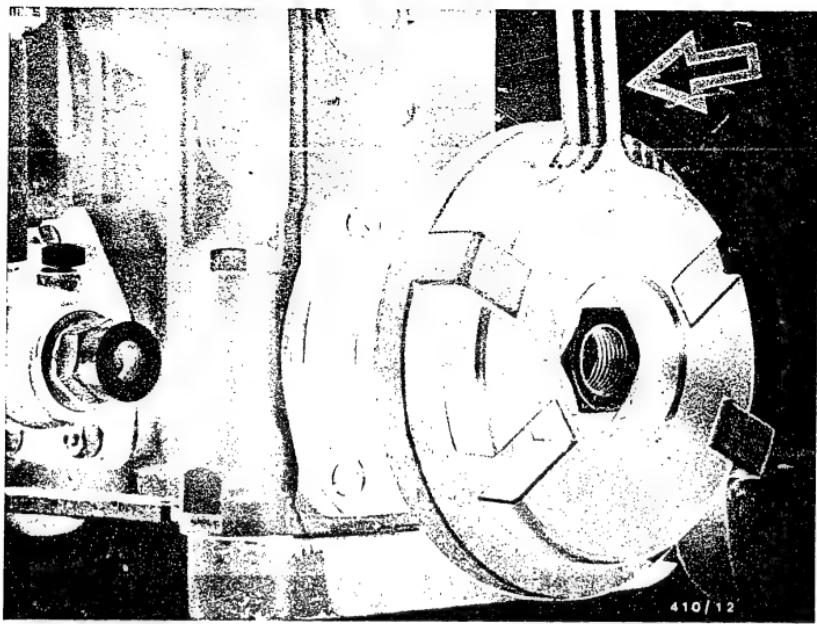
### 6.3 Removing the supply pump

Loosen hexagon nuts (see picture, arrows) and unscrew.  
Take off supply pump with gasket.

**B9**

Dismantling the injection pump  
P-pump 0 410 ..



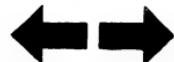


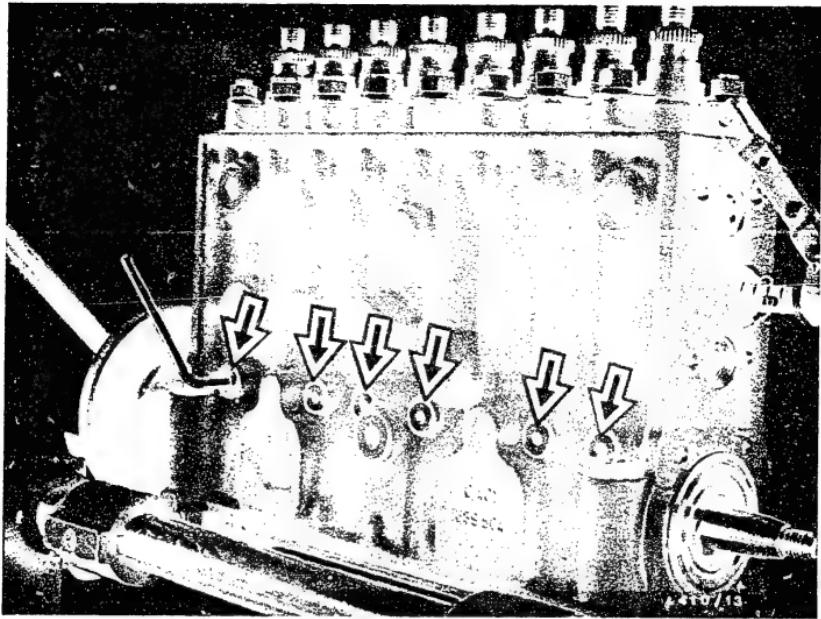
Mount drive coupling on camshaft. Hold drive coupling with holding wrench KDEP 2906 (see picture, arrow) or KDEP 2885.

**B10**

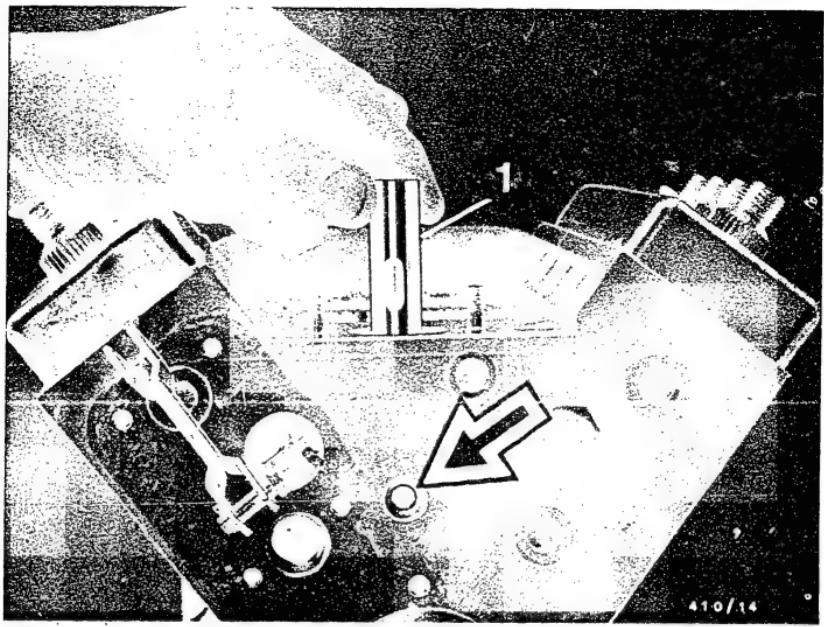
Dismantling the injection pump

P-pump 0 410 ..





Remove screw plugs (see picture, arrows) on front side of pump.

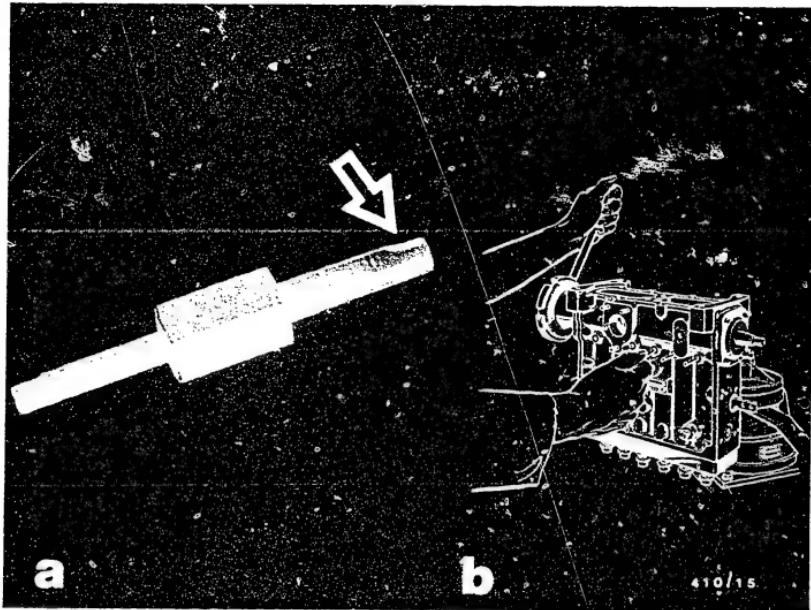


1 = Roller tappet

Note on injection pump PESV:

Before installing the tappet holders, remove slotted-head screw (see picture, arrow) (already removed in the picture).

Take roller tappets for driving the supply pump up out of their guides.



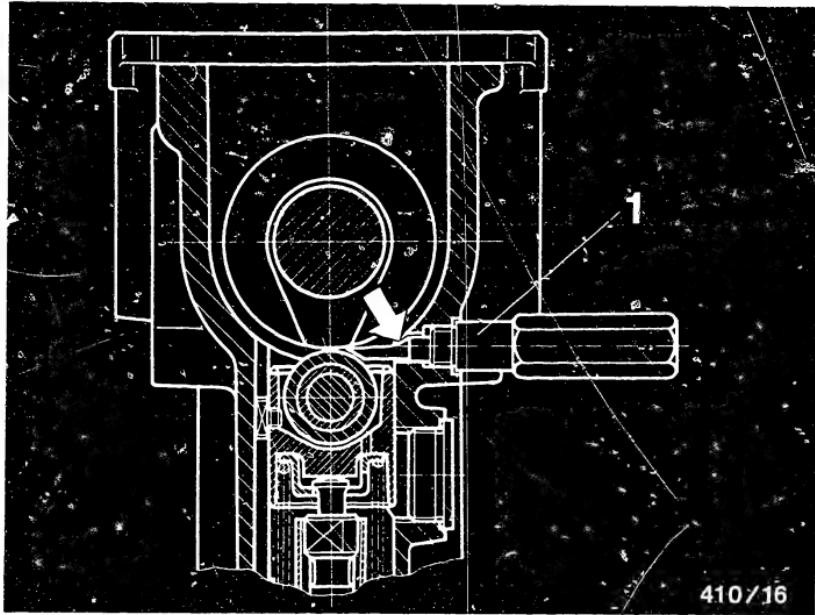
#### 6.4 Mounting the tappet holders

##### 6.4.1 Pumps without thread/without through thread in Locating bore

Use eccentric tappet holders KDEP 2910.

By turning the camshaft, bring the individual roller tappets to TDC.

Introduce tappet holder KDEP 2910 into the respective bore so that the eccentric shoulder (see picture, arrow) points downward, i.e. in the direction of the camshaft. Turn tappet holder through approx. 180°. The eccentric lifts the roller tappet off the cam of the camshaft.



1 = Guide sleeve

#### 6.4.2 Pumps with through thread in locating bore

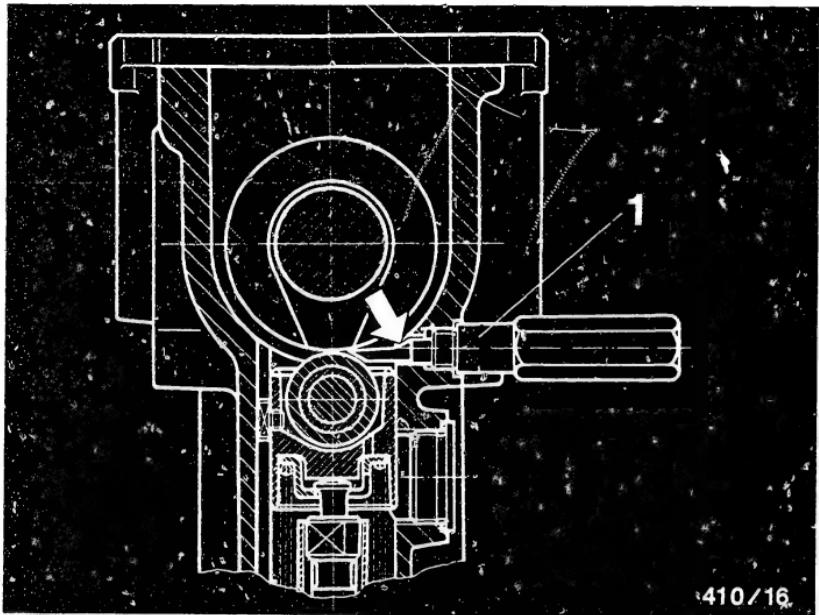
Use tappet holders KDEP 1041.

Note:

When installing the tappet holders, it must be guaranteed that the radius is pointing to the cam (see picture arrow).

First of all, try screwing in the guide sleeve by hand in order to clear any damaged threads in the pump housing.

Then remove guide sleeve again.



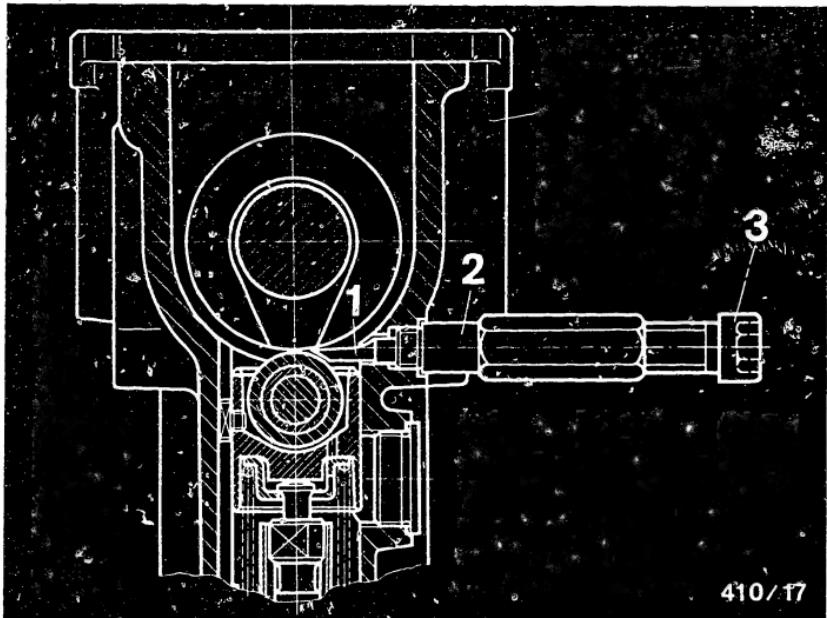
1 = Guide sleeve

Pump version S1, S800, S1000 with 10 mm lift

Set the respective cam to TDC and firstly introduce tappet holder (radius pointing toward camshaft). Slide guide sleeve over it and screw in by hand. Ensure freedom of movement of thread. Only the last 2-3 thread turns may be tightened with open-end wrench A/F 13. The camshaft must then rotate freely.

Note:

For these pump versions, do not use the hexagon-socket-head cap screws supplied with tappet holder KDEP 1041.



1 = Tappet holder

2 = Guide sleeve

3 = Hexagon-socket-head cap screw

Pump version S3000, S6000 with 11 mm lift

Set the respective cam to TDC. Introduce tappet holder. Slide guide sleeve over it and screw in by hand.

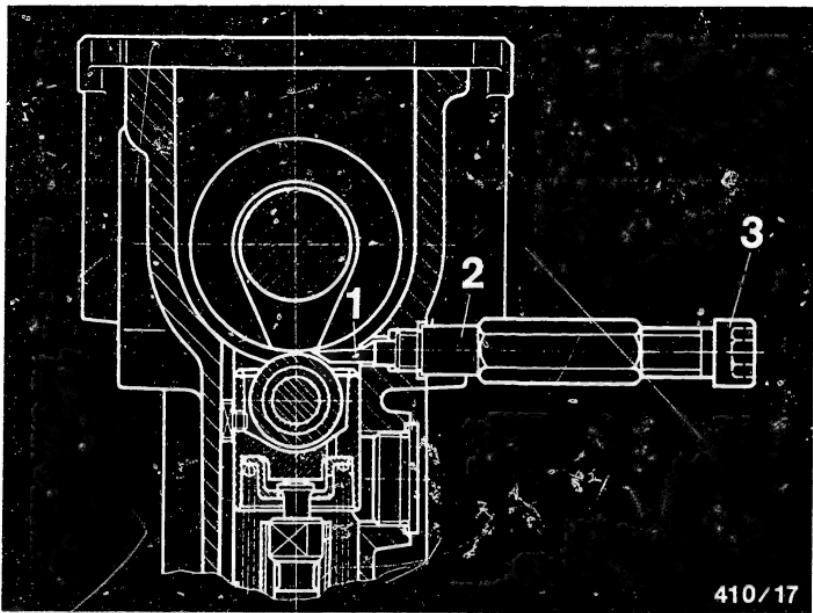
Tighten only the last turn of the thread using open-end wrench A/F 13.

By turning the hexagon-socket-head cap screw by hand, bring the tappet holder up against the roller tappet. Using a hexagon-socket-screw key, screw in the hexagon-socket-head cap screw by a further approx. 1/2 turn.

Note:

Do not screw in the tappet holder too far so that the cam does not brush against the tappet holder.

After raising all roller tappets, the camshaft must rotate freely.



410/17

1 = Tappet holder

2 = Guide sleeve

3 = Hexagon-socket-head cap screw

#### Pump version S7000 with 12 mm lift

Set the respective cam to TDC. Introduce tappet holder. Slide guide sleeve over it and screw in by hand.

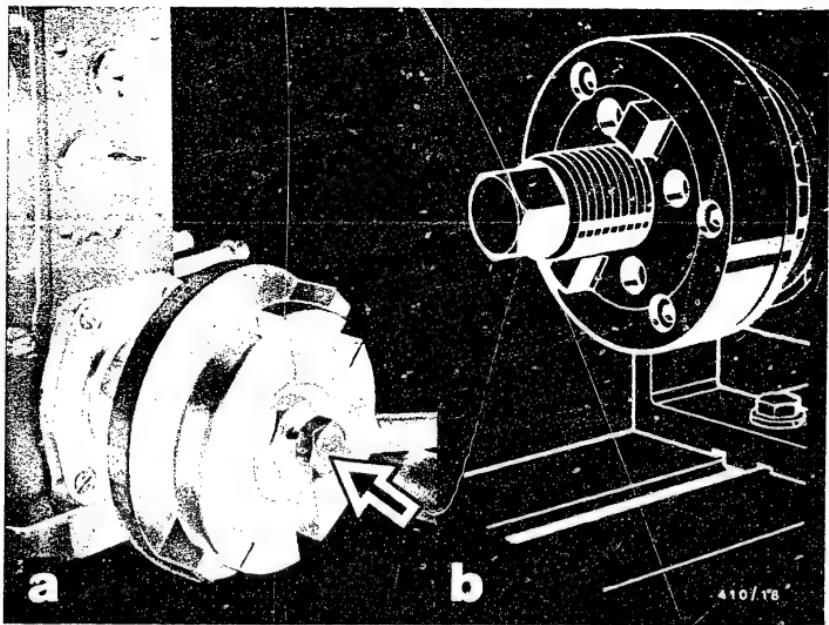
Tighten only the last turn of the thread using open-end wrench A/F 13.

By turning the hexagon-socket-head cap screw by hand, bring the tappet holder up against the roller tappet. Using a hexagon-socket-screw key, screw in the hexagon-socket-head cap screw by a further approx. 1/4 turn.

#### Note:

Do not screw in the tappet holder too far so that the cam does not brush against the tappet holder.

After raising all roller tappets, the camshaft must rotate freely.



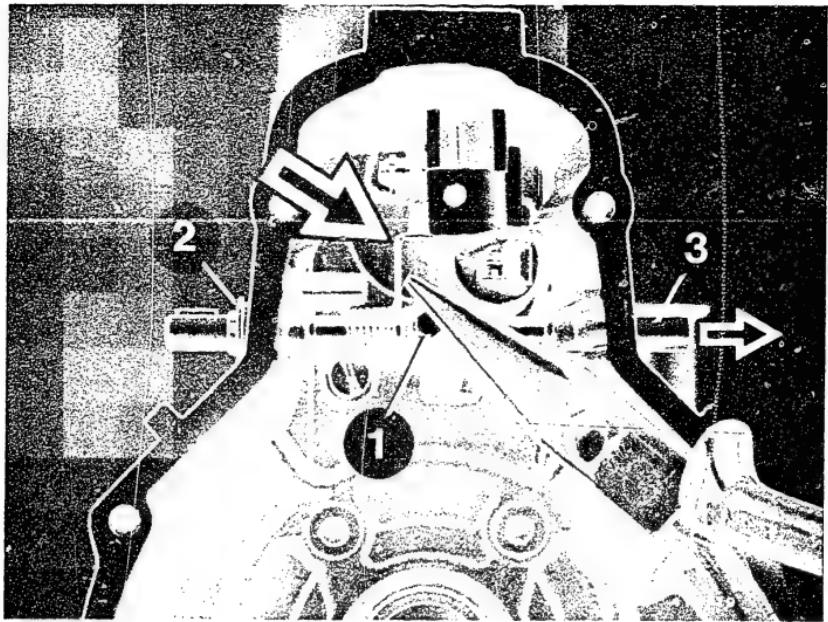
### 6.5 Pulling off the drive coupling

Using holding wrench KDEP 2906 for slot width 10 mm and KDEP 2885 for 12 mm slot width, bring the drive coupling up against the clamping support (see picture a).

Screw appropriate puller (arrow) into drive coupling and pull drive coupling off camshaft.

Note:

For pump series ..S800 and S3800, use the 3-part puller KDEP 1557 (picture b).



1 = Hexagon screw

2 = Split pin

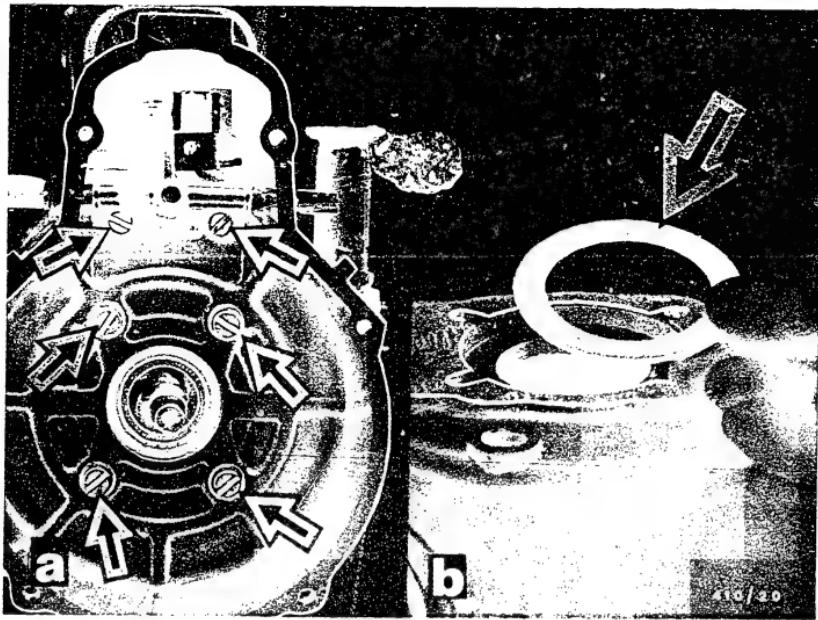
3 = Setting shaft

#### 6.6 Removing the shutoff device

Unhook spring (see picture, arrow).

Loosen hexagon screw.

Remove split pin and withdraw setting shaft from the side.



### 6.7 Removing the governor housing

Unscrew fastening screws from governor housing (arrows - picture a).

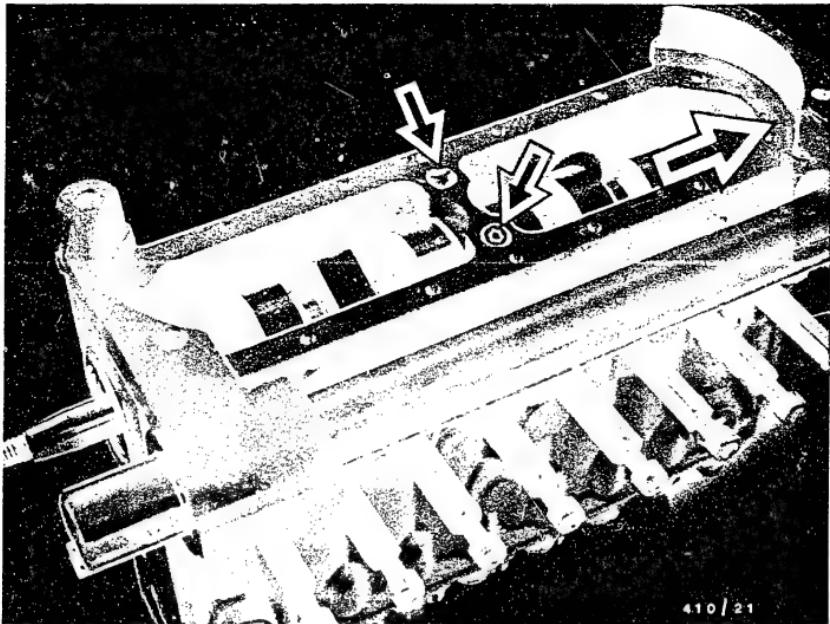
Take off governor housing.

Note:

Pay attention to support ring (see picture b, arrow) for setting the projection dimension.

### 6.8 Removing the bearing end plate

Remove bearing end plate fastening screws. Lever off bearing end plate evenly with screwdriver.

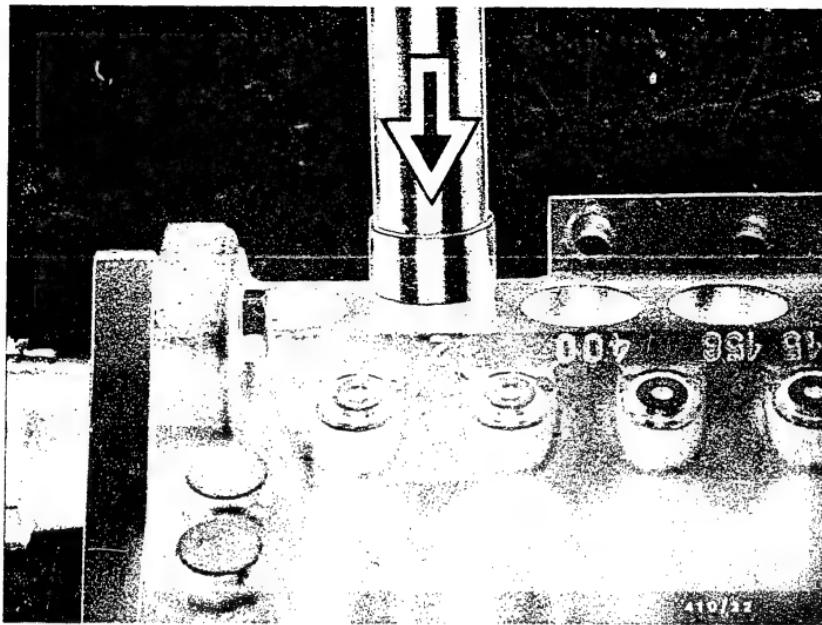


### 6.9 Removing the camshaft

Remove base plate.

If there is an intermediate bearing, loosen fastening screws and unscrew.

Withdraw camshaft with tapered-roller bearing and intermediate bearing from the camshaft chamber in the direction of the arrow.



Injection pump PESV:

Using press-out mandrel KDEP 1574, knock the base end covers inward.

Note:

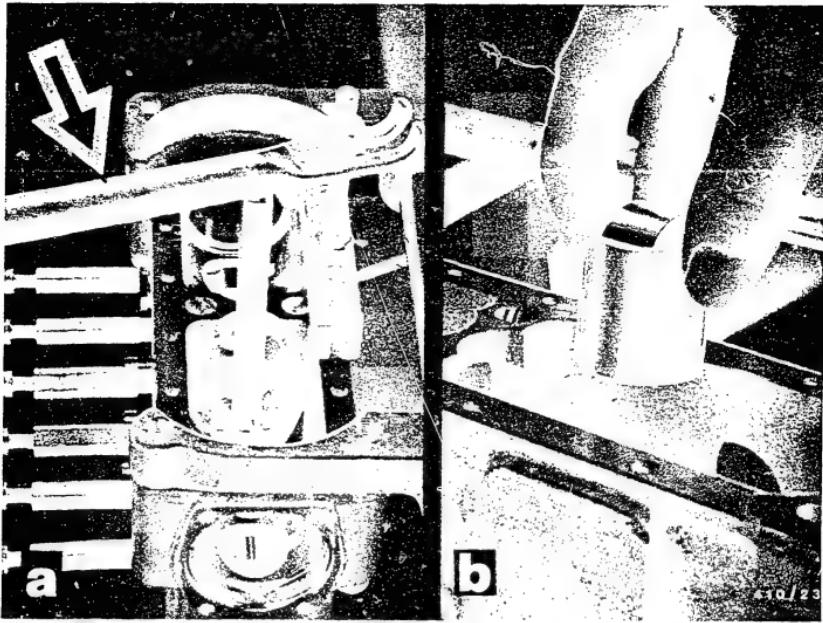
The picture shows the pressing in of the base end covers. To knock out, turn the mandrel through 180°.

**B22**

Dismantling the injection pump

P-pump 0 410 ..





#### 6.10 Removing the roller tappets (in-line injection pumps)

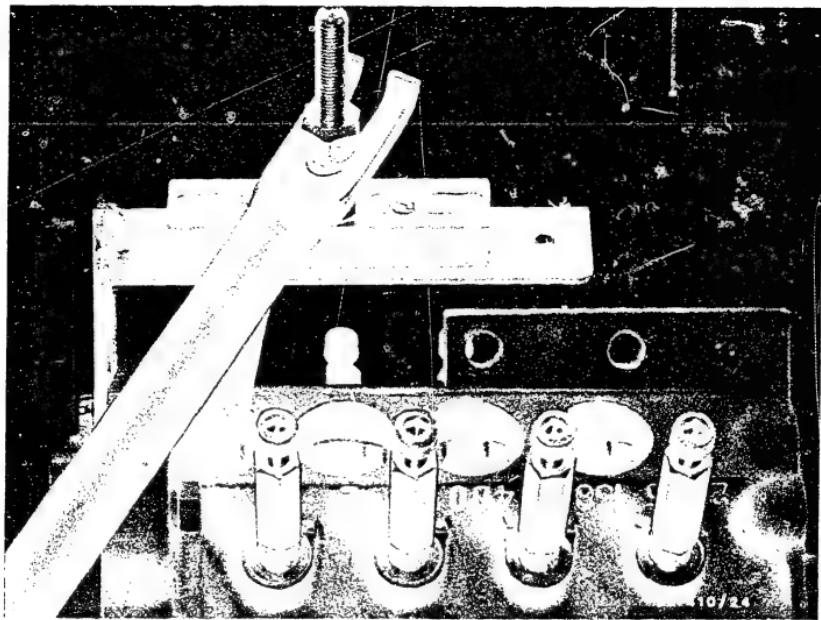
Tilt the pump. Mount assembly device KDEP 1505 (see picture a, arrow) (or KDEP 1067 or KDEP 2888- not shown) on pump.

Place tappet of device on roller of roller tappet and, using lever, press down roller tappet. In this position, loosen tappet holder KDEP 1041 and remove.

After removing the tappet holder, relax the plunger spring.

Remove the assembly device.

Take roller tappets out of tappet guides.



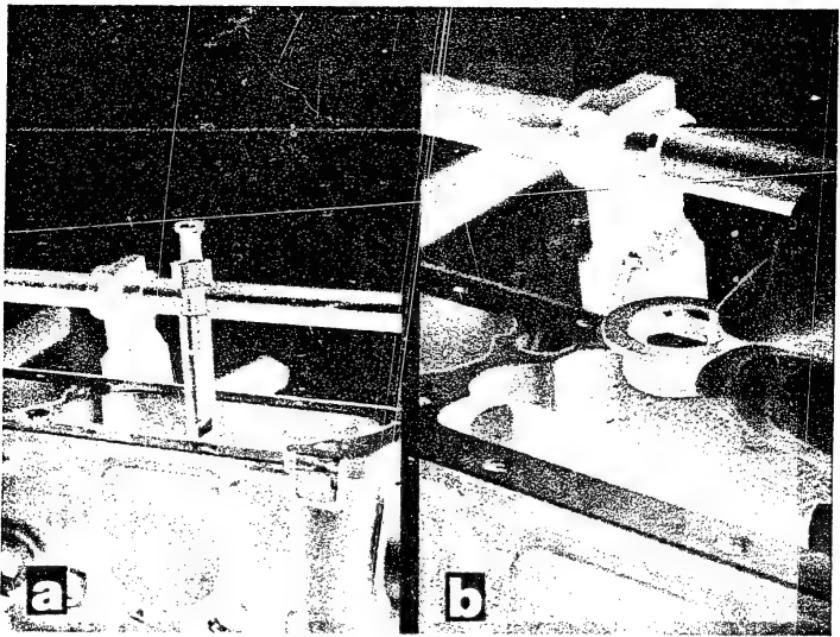
### Injection pump PESV

When using the assembly device KDEP 1505, it is necessary to use the holding bracket KDEP 1505/1 (see picture).

**B24**

Dismantling the injection pump  
P-pump 0 410 ..





Withdraw pump plungers (see picture a) and spring seats (see picture b) and lay aside.

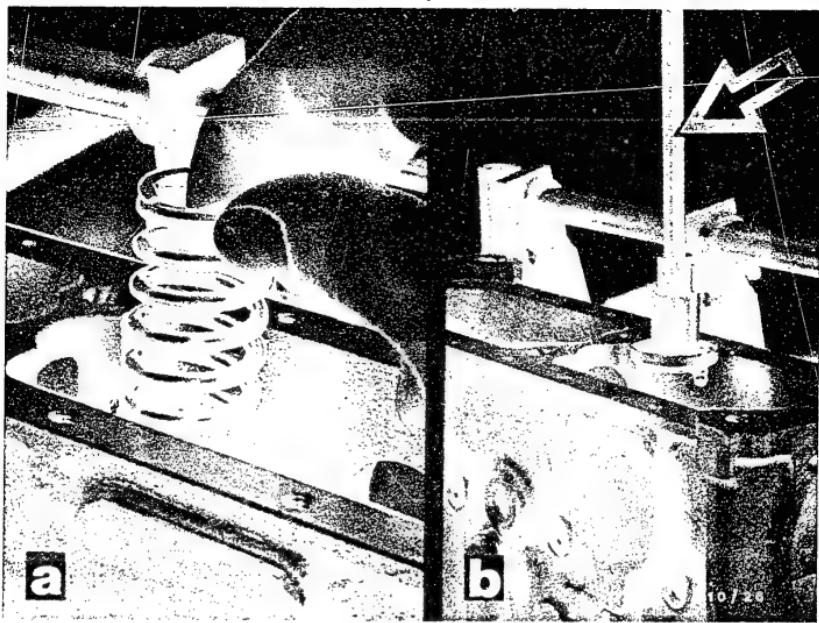
Warning:

Pump plungers must not be mixed up, i.e. lay aside all components belonging to each cylinder and keep in separate trays.

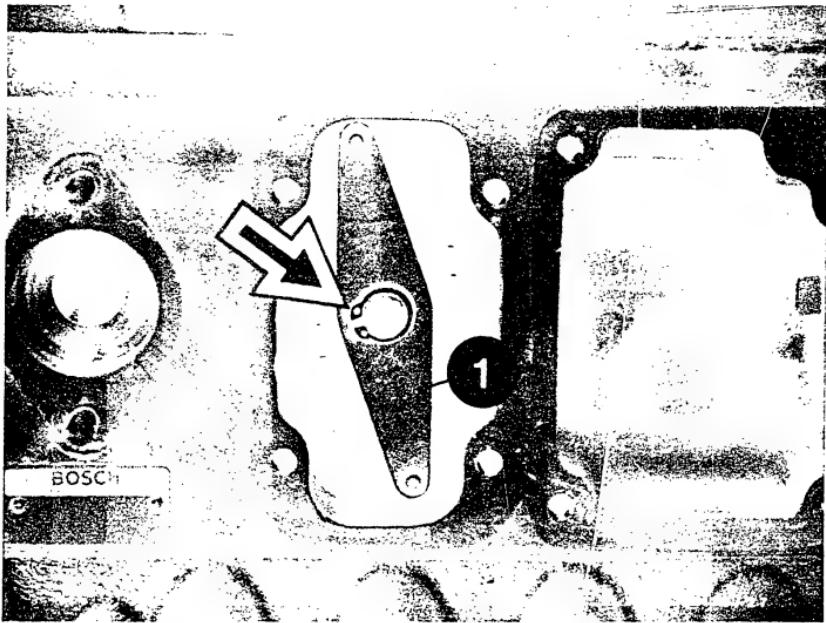
**C1**

Dismantling the injection pump  
P-pump 0 410 ..





Take out compression springs (see picture a).  
Remove control sleeve (see picture b, arrow) and upper  
spring seat together using KDEP 1071.  
Control rod must be in center position.  
The projecting driver ball is in the housing recess for  
the roller tappet guide.

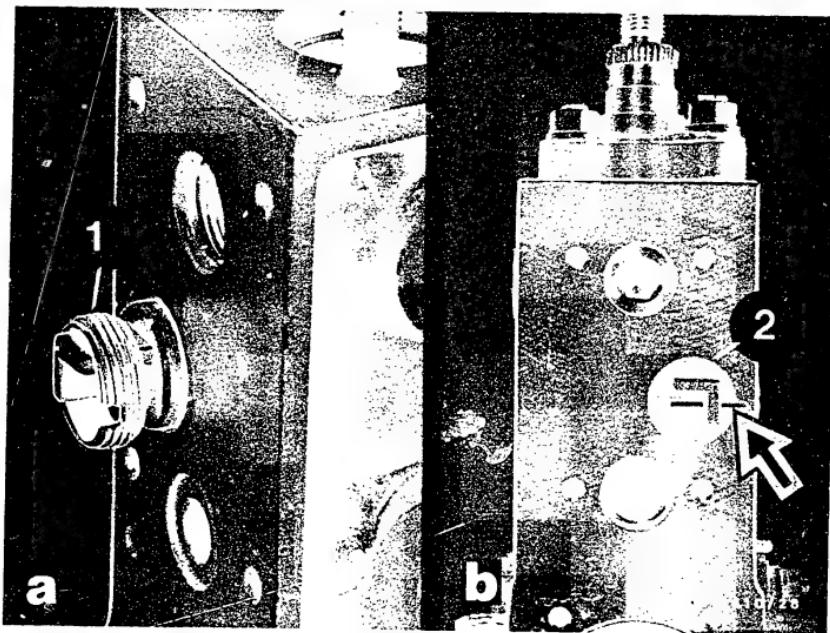


1 = Reverse-transfer lever

Injection pump PESV:

Unscrew the center closing cover between both rows of plunger-and-barrel assemblies.

Remove retainer (see picture, arrow) from the shaft of the reverse-transfer lever and remove reverse-transfer lever.



1 = Threaded ring

2 = Guide bushing

#### 6.11 Removing the control rod

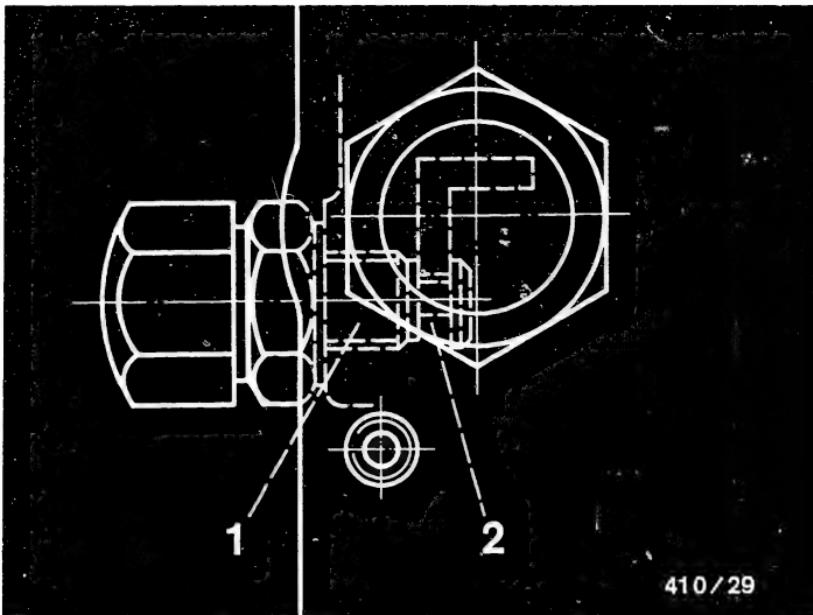
Screw out threaded ring with socket pin wrench KDEP 2970.  
Remove locating pin (see picture b, arrow).

Pull out control rod opposite drive end.

Remove control rod screw plug at drive end and take out  
guide bushing.

Note:

If stuck, use long mandrel to knock out guide bushing  
opposite drive end.

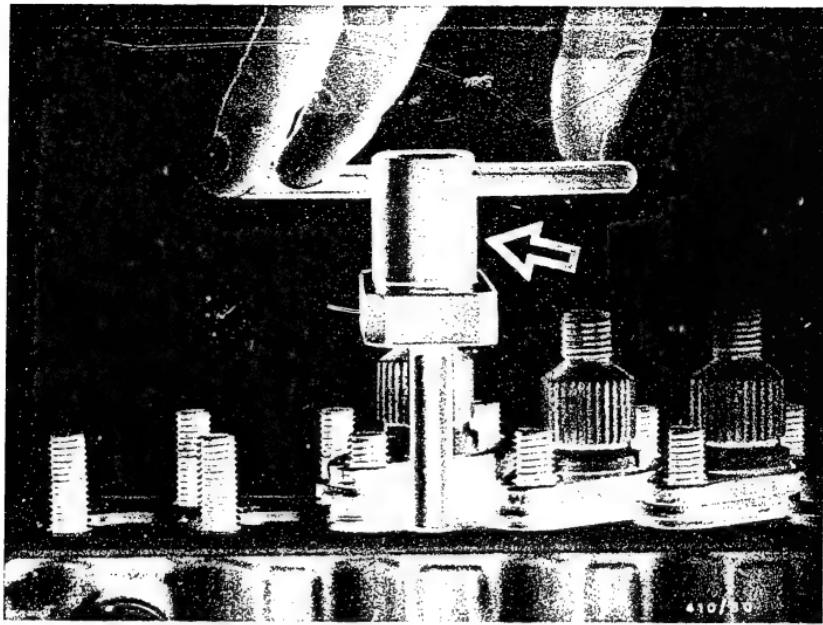


- 1 = Control rod guide screw  
2 = Control rod guide

#### 6.11.1 Removing the control rod on 10 and 12 cylinder pumps

These injection pumps have additional control rod guide screws (see picture).

These screws cannot be screwed out until after the control rod has been removed.



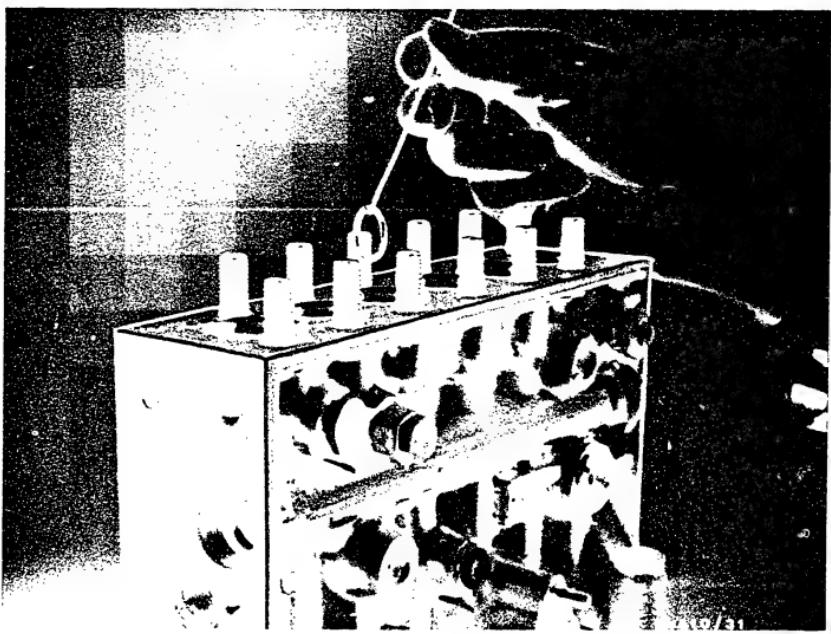
### 6.12 Removing the flange-bushing plunger-and-barrel assembly

Remove caps on barrel-and-valve assemblies. Unscrew hexagon nuts of flange bushings. Remove spring lock washers and pressure plates/shims. Using puller K2911 (see picture, arrow) remove barrel-and-valve assemblies.

Note:

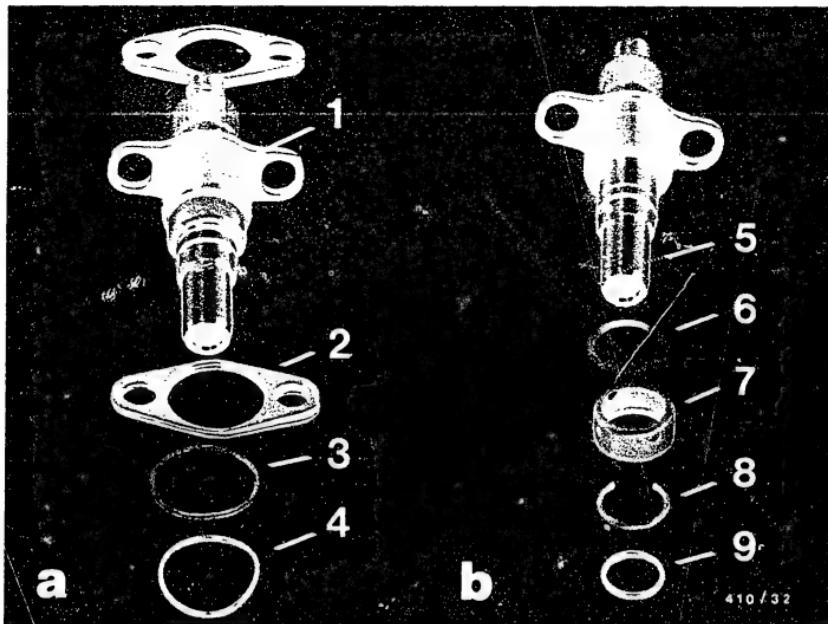
When laying aside the barrel-and-valve assemblies, be sure to follow the same sequence as when removing the pump plungers. Do not mix up the pump plungers and the pump barrels contained in the barrel-and-valve assemblies. Take off prestroke adjusting shims (one-part or split).

Split prestroke shims are used on all P-pumps as of FD 626 (June 76).



This makes it possible to set the prestroke without removing the barrel-and-valve assemblies. At the same time, there is a clear improvement in leak-tightness because the O-ring need not be removed for setting the prestroke.

Remove the remaining seal rings of the barrel-and-valve assemblies (in the pump housing) (see picture).



- |                                 |              |
|---------------------------------|--------------|
| 1 = Flange bushing              | 6 = Shim     |
| 2 = Prestroke adjusting shims   | 7 = Capsule  |
| 3 = Spacer ring                 | 8 = Retainer |
| 4 = O-ring                      | 9 = O-ring   |
| 5 = Plunger-and-barrel assembly |              |

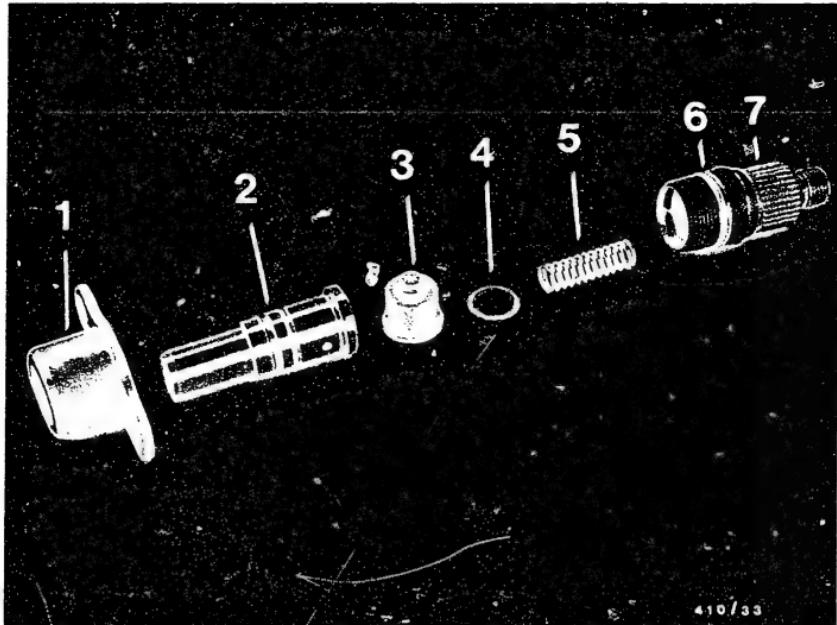
6.13 Dismantling the flange-bushing plunger-and-barrel assembly

(Series P..1/P.. 1000/P.. 3000)

Picture a: Remove O-ring, spacer ring and prestroke adjusting shims from flange bushing.

Note: Split prestroke shims are used as of FD 626 (June 76).

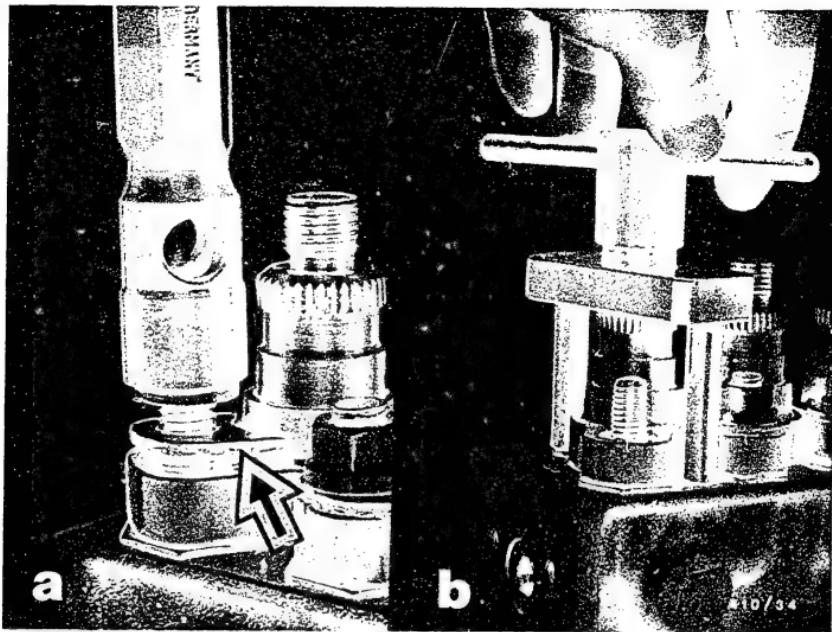
Picture b: Remove retainer and O-ring from plunger-and-barrel assembly. Take off capsule and shim.



410/33

- |                    |                           |
|--------------------|---------------------------|
| 1 = Flange bushing | 5 = Valve spring          |
| 2 = Pump barrel    | 6 = O-ring                |
| 3 = Delivery valve | 7 = Delivery-valve holder |
| 4 = Seal ring      |                           |

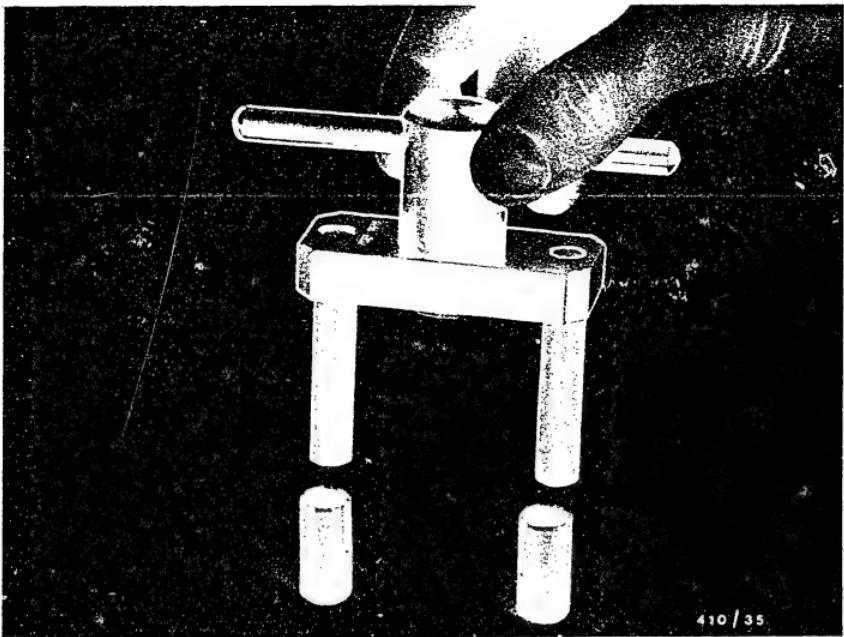
Clamp assembly device KDEP 2962 in vise and insert barrel-and-valve assembly into assembly device. Unscrew delivery-valve holder using socket wrench KDEP 2986. Remove O-ring from delivery-valve holder. Remove valve spring with filler piece (if applicable) from delivery valve. Take delivery valve with seal ring and pump barrel out of flange bushing.



#### 6.14 Removing the flange-type plunger-and-barrel assembly (Series P..6000/P..7000)

Remove cap from barrel-and-valve assembly. Unscrew hexagon nuts on flange-type plunger-and-barrel assembly and take off fastening plates (see picture, arrow). Pull off flange-type plunger-and-barrel assembly using puller KDEP 2911. Take off split prestroke shims (1).

Split prestroke shims are used on all P-pumps as of FD 626. This means that the prestroke can be set without removing the barrel-and-valve assemblies. There is also a clear improvement in leak-tightness because the O-ring need not be removed for setting the prestroke.

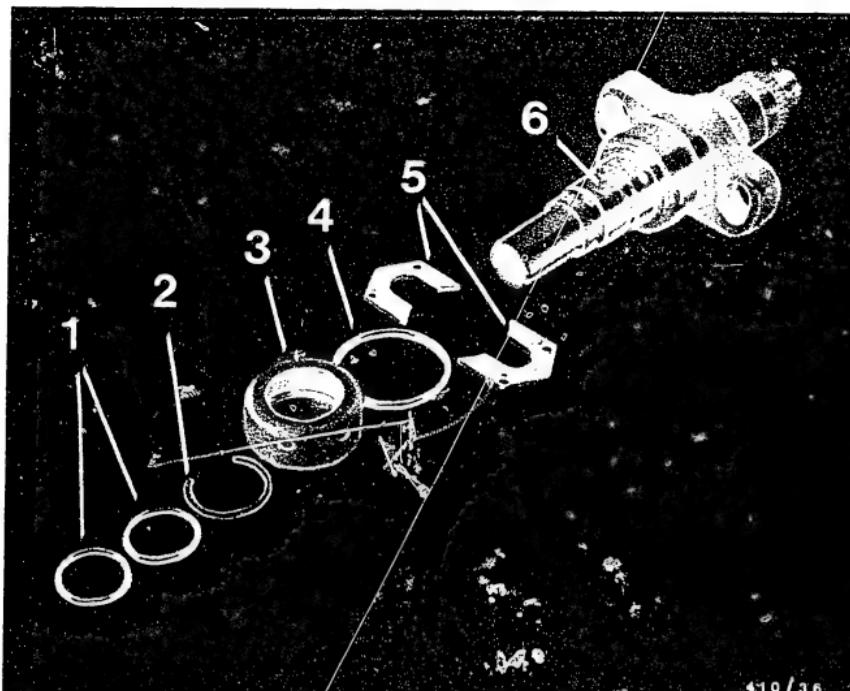


410 / 35

Note:

On pump series P..6000/P..7000, pull off flange-type plunger-and-barrel assembly using puller KDEP-2911 in conjunction with 1 set of sleeves KDEP 2911/2/1.

When laying aside the barrel-and-valve assemblies, be sure to follow the same sequence as when removing the pump plungers. Do not mix up the pump plungers and the corresponding barrel-and-valve assemblies.



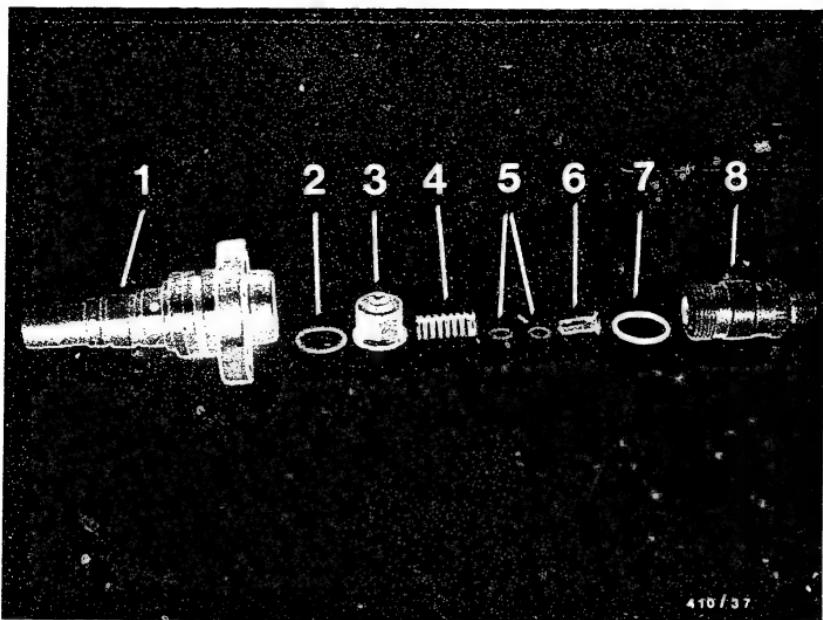
410 / 36

- 1 = O-rings
- 2 = Retainer
- 3 = Capsule
- 4 = O-ring
- 5 = Split prestroke shim
- 6 = Plunger-and-barrel assembly

#### 6.15 Dismantling the flange-type plunger-and-barrel assembly

Remove retainer from plunger-and-barrel assembly and take off capsule.

Remove O-rings.



410 / 37

- |                    |                           |
|--------------------|---------------------------|
| 1 = Pump barrel    | 5 = Shims                 |
| 2 = Gasket         | 6 = Filler piece          |
| 3 = Delivery valve | 7 = O-ring                |
| 4 = Valve spring   | 8 = Delivery-valve holder |

Position barrel-and-valve assembly in assembly device KDEP 2962.

Loosen delivery-valve holder with socket wrench KDEP 2986 and unscrew.

Remove O-ring from delivery-valve holder.

Take off valve spring with filler piece from delivery valve.

Take delivery valve with gasket out of pump barrel.

## 7. Cleaning the parts

Wash the parts in low-inflammability, commercially available cleaning agent, e.g. Chlorothene NU. Then blow off with compressed air.

Observe the following safety regulations.

Decree on Working with Combustible Liquids (Vbf) issued by the Federal Ministry of Labor (BmA).

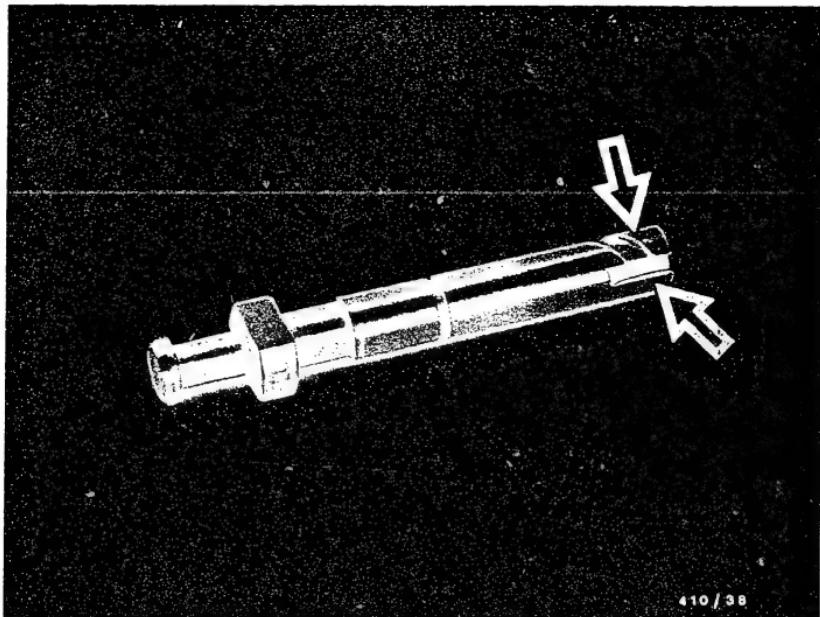
Safety rules for handling chlorinated hydrocarbons  
for the workshop ZH 1/222

for the employee ZH 1/119

issued by the Central Association of German Employers' Liability Insurance Associations (Central Association for Accident Prevention and Industrial Medicine)  
Langwartweg 103, D-5300 Bonn 5.

In countries outside the Federal Republic of Germany, observe the corresponding local regulations.





410 / 38

#### 8. Checking the individual components - Assessing for wear

Worn or damaged components must be replaced. Gaskets and O-rings must always be replaced. Pay particular attention to helixes on the pump plungers. The helixes must be sharp-edged and must not be rounded (see picture, arrows).

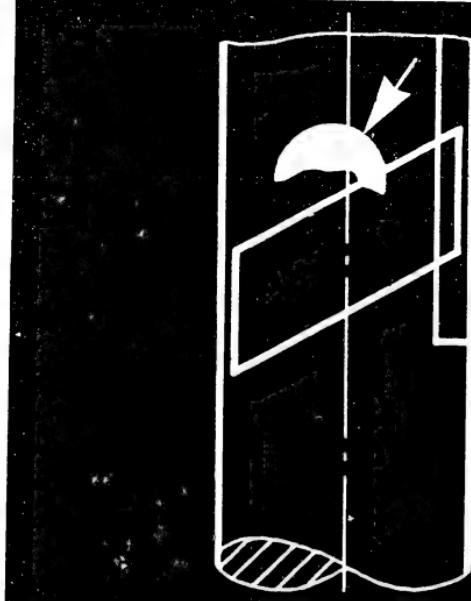
The bearing surfaces must not show any traces of wear or scoring.

**C15**

Checking the individual components

P-pump 0 410 ..





410 / 39

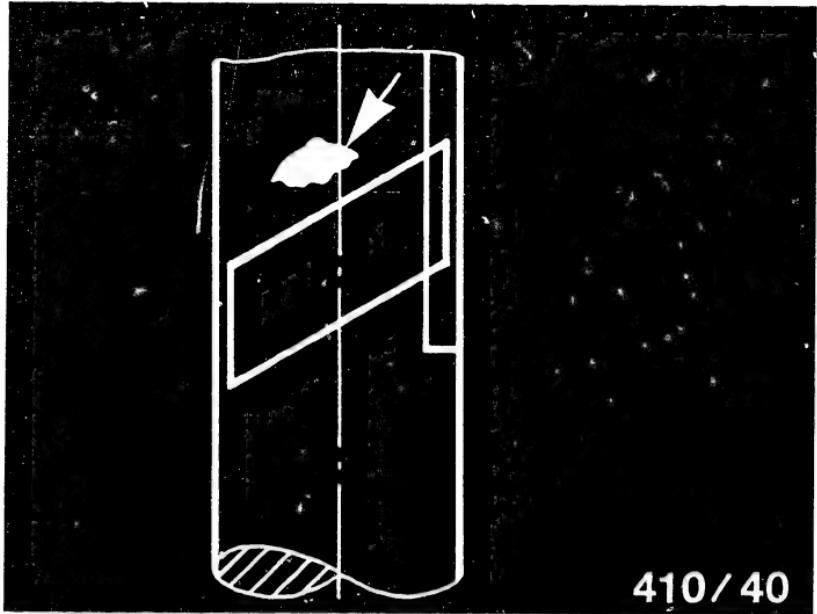
To rule out any uncertainty when assessing plunger-and-barrel assemblies, note the following:

Replacement of the plunger-and-barrel assemblies is justified in the case of:

- Cavitation (material erosion) in the region of the helixes (see picture, arrow).
- Seizing or sticking of plunger as a result of dirt or surface coatings - detectable by glide test - plunger in barrel.

Note:

Before the glide test, wash out the pump plunger and barrel in calibrating oil. Hold pump plunger and barrel more or less vertical. Pump plunger must glide in barrel under its own weight.



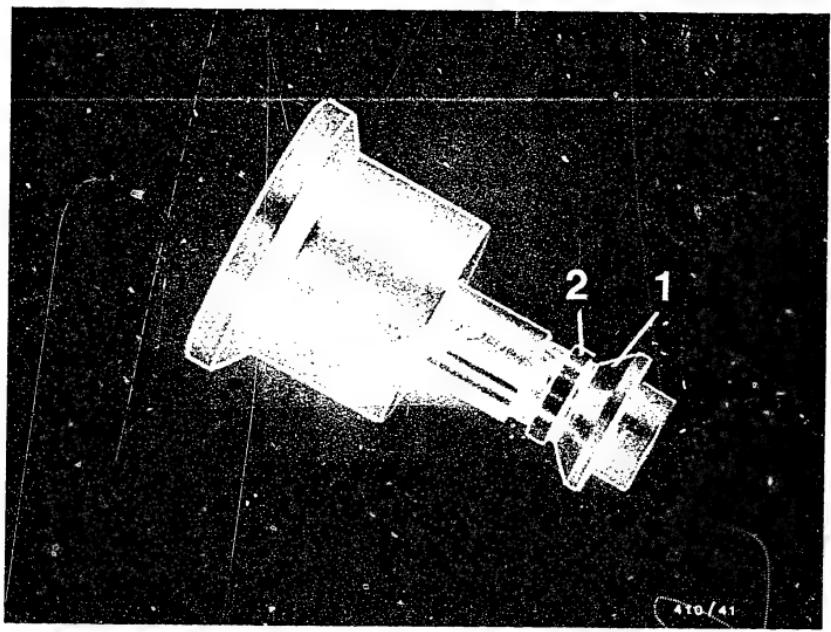
410/40

Replacement of the plunger-and-barrel assemblies is not justified in the case of:

- Cavitation (material erosion) above the helix (see picture, arrow).
- Dull patches over the entire circumference
- Bright bearing marks (without scoring and without mechanical wear)
- Discoloration on plunger and flange-type barrel as a result of fuel and lubricant deposits, water in fuel or influence of temperature.

Note:

When repairing, do not as a basic rule replace plunger-and-barrel assemblies and delivery valves separately.



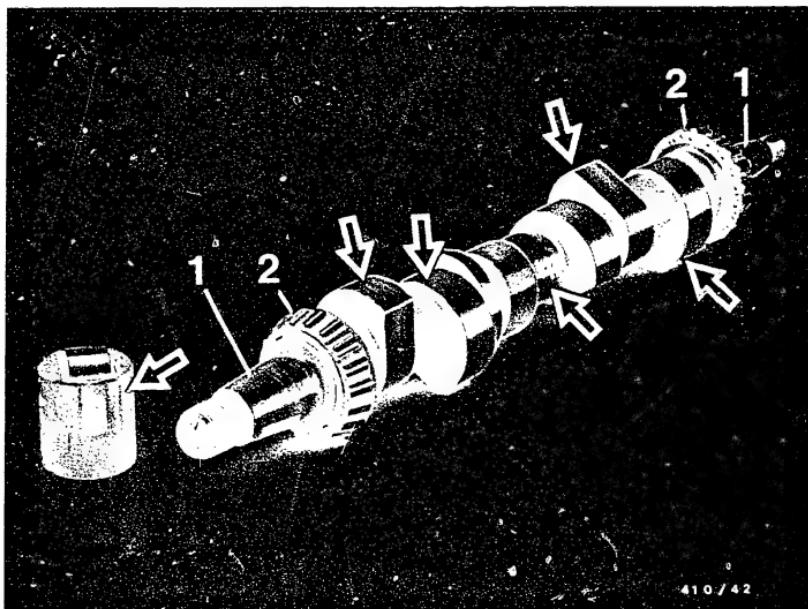
1 = Valve cone

2 = Retraction piston

#### Checking the delivery valves

The seat of the valve cone must not be pounded in or unevenly worn.

If the retraction piston is damaged, or if the valve is sticking in the valve holder, replace the delivery valve.



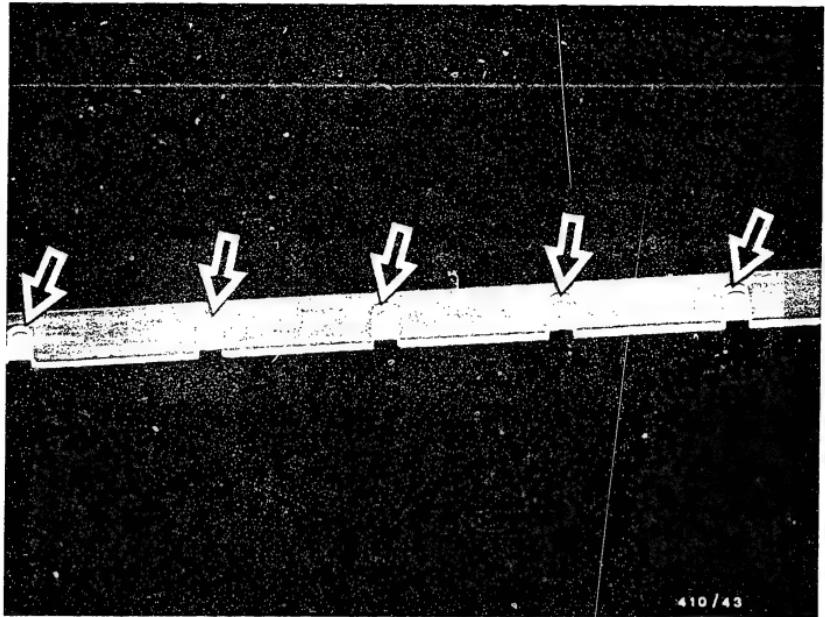
410/42

1 = Cone

2 = Camshaft bearing

If roller tappets and camshaft show heavy traces of wear (see picture, arrows) or if a cone shows damage, replace camshaft and roller tappets. Intermediate bearings which show traces of wear must be replaced. Always replace camshaft bearings, seals, seal rings and O-rings when repairing.

**C19**Checking the individual components  
P-pump 0 410 ..

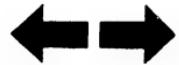


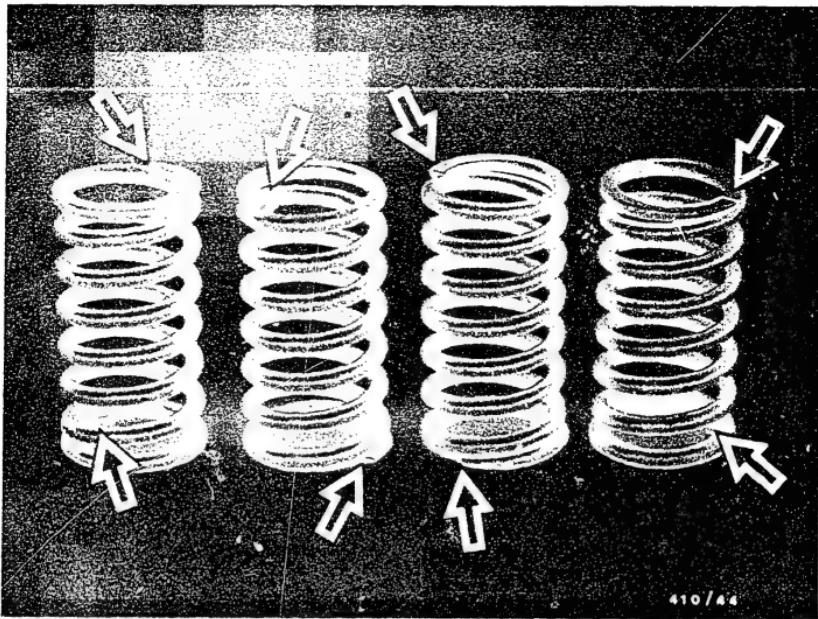
410 / 43

Check the control rod for worn grooves (see picture, arrows) (drivers of control sleeve).

**C20**

Checking the individual components  
P-pump 0 410 ..





410 / 44

### Checking the plunger springs

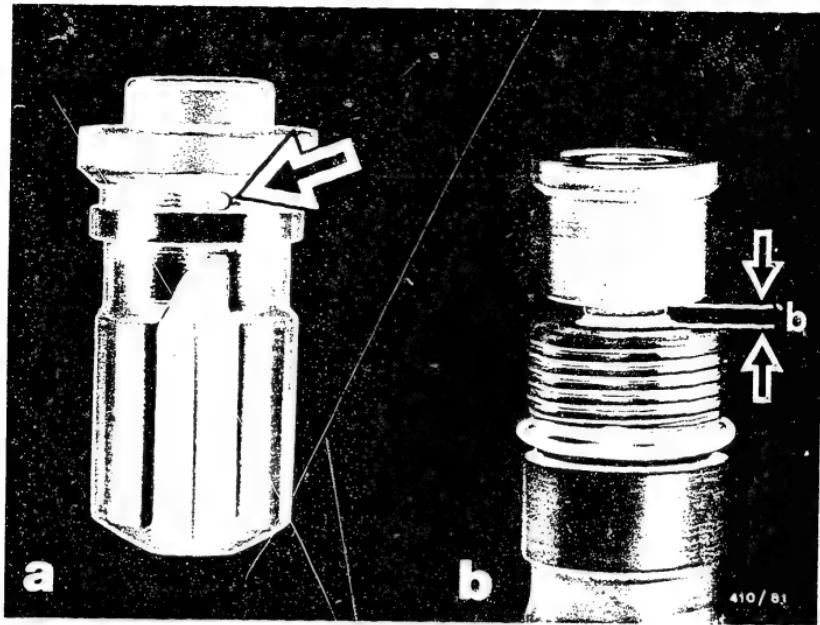
Plunger springs which are corroded or whose surface is damaged must be replaced due to the danger of breakage. Check in particular the area of the seating surface of the 1st turn (see picture, arrows).

**C21**

Checking the individual components

P-pump 0 410 ..





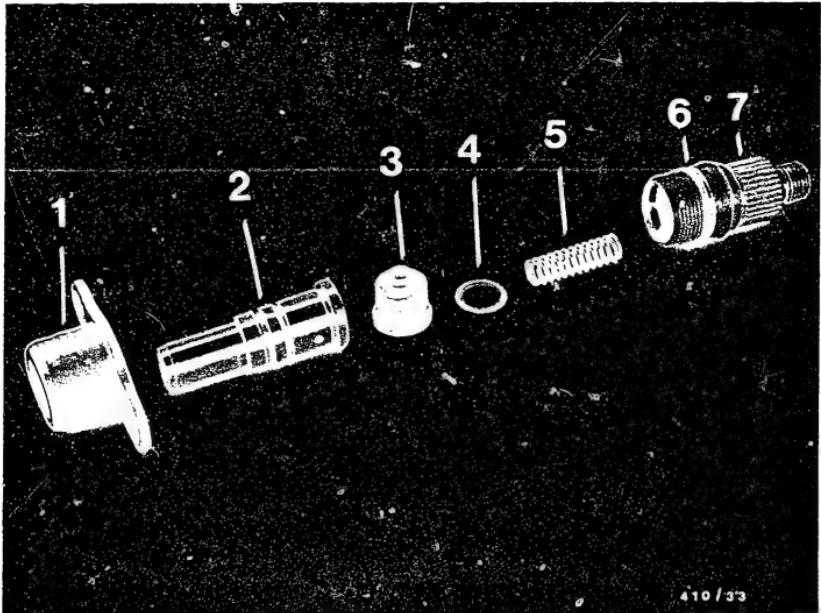
410/81

### 9. Setting the spring preload of torque-control delivery valves

Torque-control delivery valves can be identified by the idle bore (see picture a, arrow).

Check the spring preload as follows:

- Clamp delivery-valve holder in vise with spring chamber at top.
- Insert filler piece (if applicable) and compression spring.
- Mount delivery valve with valve holder and seal ring.
- Measure dimension "b" (see picture b). If the dimension for the spring preload given in the test-specification sheet is not obtained, add washers.  
If the dimension is too great, change washers or replace compression spring, as appropriate.



410 / 33

- |                                 |                    |
|---------------------------------|--------------------|
| 1 = Flange bushing              | 5 = Valve spring   |
| 2 = Plunger-and-barrel assembly | 6 = O-ring         |
| 3 = Delivery valve              | 7 = Delivery-valve |
| 4 = Seal ring                   | holder             |

#### 10. Assembling the barrel-and-valve assemblies

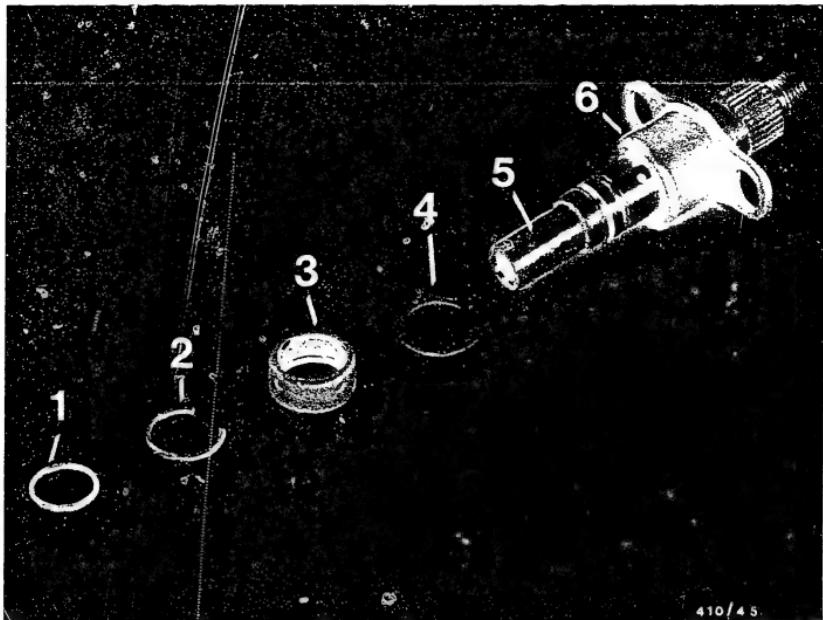
##### 10.1 Assembling the flange-bushing plunger-and-barrel assembly

Insert flange bushing in assembly device KDEP 2962.  
Insert plunger-and-barrel assembly.

Insert delivery valve with seal ring and valve spring with filler piece (if applicable).

Provide delivery-valve holder with O-ring and wet male thread with oil-tallow mixture (5 963 340 105). Then screw into flange bushing.

Tighten delivery-valve holder to 80-90 Nm with socket wrench KDEP 2986.

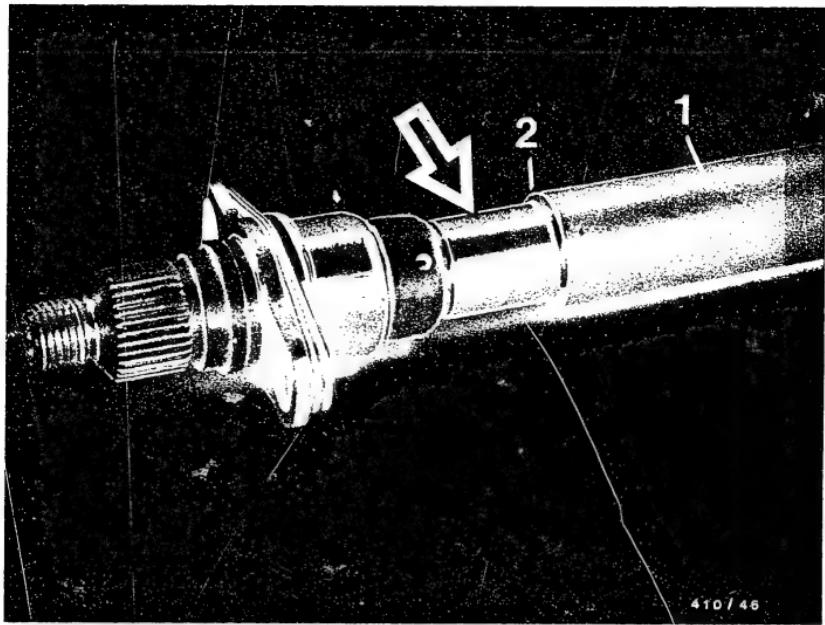


1 = O-ring  
2 = Retainer  
3 = Capsule

4 = Shim  
5 = Pump barrel  
6 = Flange bushing

Take flange-bushing plunger-and-barrel assembly out of assembly device. Slip shim onto plunger-and-barrel assembly so that it is up against the collar of the flange bushing.

Slip capsule onto pump barrel so that the holes are opposite the flange bushing. Do not yet mount retainer and O-ring.



410 / 46

1 = Force-piece

2 = Retainer

Slide conical sleeve of assembly sleeve set KDEP 1046 (see picture, arrow) onto pump barrel.

Slide retainer onto conical sleeve and, using force-piece, press retainer into upper annular groove of pump barrel.

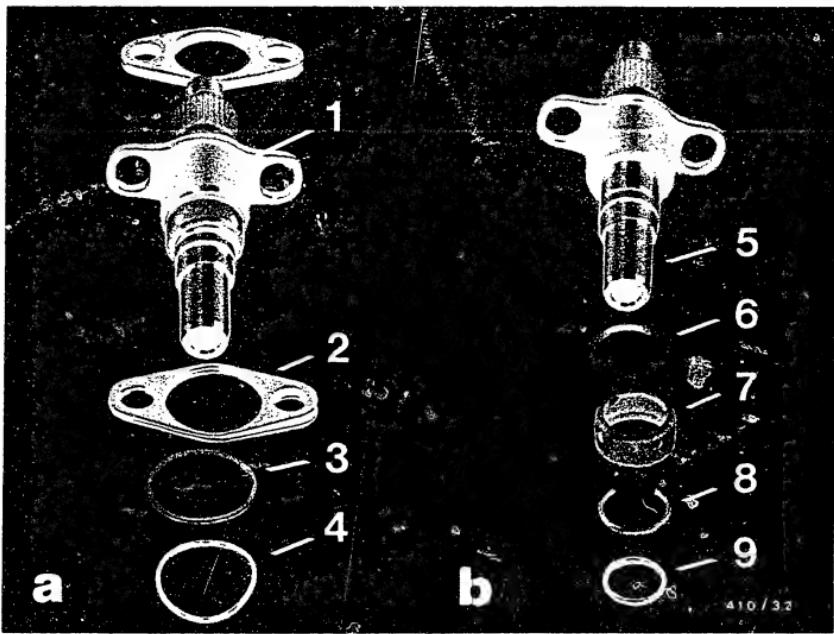
Remove assembly sleeve set and insert O-ring into lower annular groove of pump barrel (not shown).

D1

Assembling barrel-and-valve assys

P-pump 0 410 ..





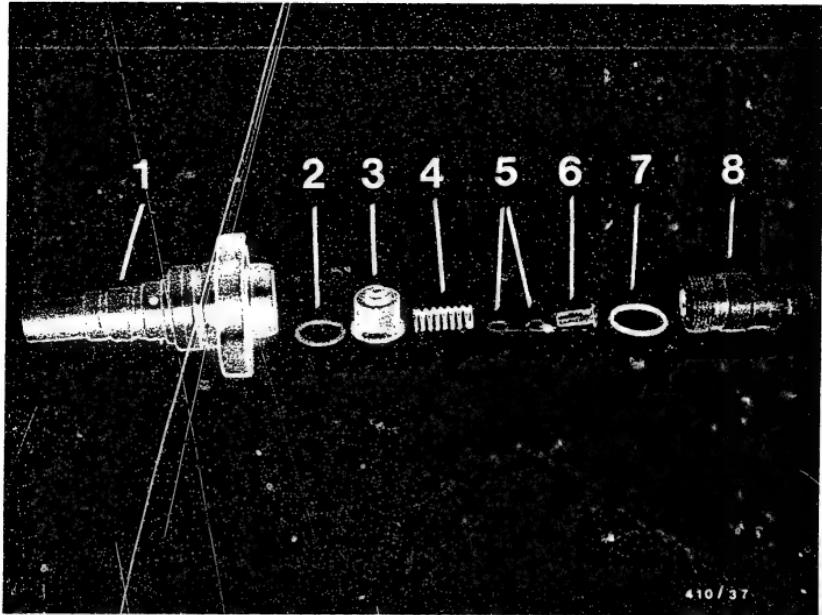
- 1 = Flange bushing  
 2 = Prestroke adjusting shims  
 3 = Spacer ring  
 4 = O-ring  
 5 = Plunger-and-barrel assembly

- 6 = Shim  
 7 = Capsule  
 8 = Retainer  
 9 = O-ring

Mount parts 2, 3, 4 only when installing the barrel-and-valve assembly. On old pump versions with a small capsule, make sure when inserting the retainer that at least one of the inlet bores on the pump barrel remains clear.

Note:

If ordering replacements, note that only new plunger-and-barrel assemblies are now supplied.  
Also use new capsules and shims.



1 = Pump barrel  
2 = Bronze gasket  
3 = Delivery valve  
4 = Valve spring

5 = Shim  
6 = Filler piece  
7 = O-ring  
8 = Delivery-valve holder

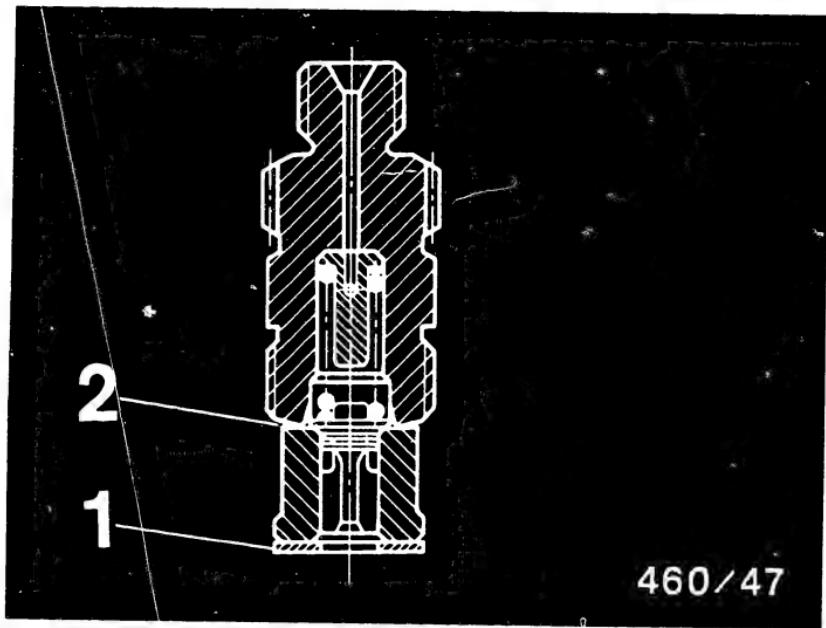
#### 10.2 Assembling the flange-type plunger-and-barrel assembly

Position pump barrel in assembly device KDEP 2962. Insert bronze gasket and delivery valve with shims and filler piece (if applicable) in pump barrel.

Note:

Bronze gasket must be installed between pump barrel and delivery valve.

Provide delivery-valve holder with O-ring and wet male thread with oil-tallow mixture (5 963 340 105). Then tighten to 110-120 Nm with socket wrench KDEP 2962.



460/47

1 = Bronze gasket

2 = Delivery-valve biting edge

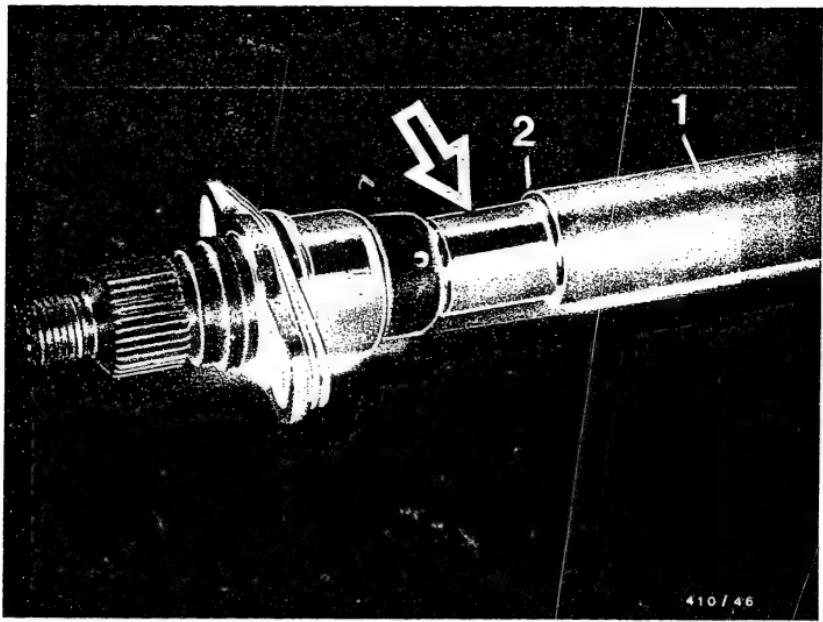
Note:

Whenever the delivery-valve holder has been loosened (e.g. when replacing the valve), replace the bronze gasket between valve holder and barrel.

Visually examine the gasket and delivery-valve biting edge for surface defects. In the case of scoring and scratches, replace the parts concerned.

Briskly tighten the delivery-valve holder to a torque of 110 - 120 Nm.

Do not loosen and re-tighten.



410 / 46

1 = Force-piece

2 = Retainer

Take barrel-and-valve assembly out of assembly device KDEP 2962.

Place capsule on pump barrel.

Slide conical sleeve (arrow) from assembly sleeve set KDEP 1046 onto pump barrel.

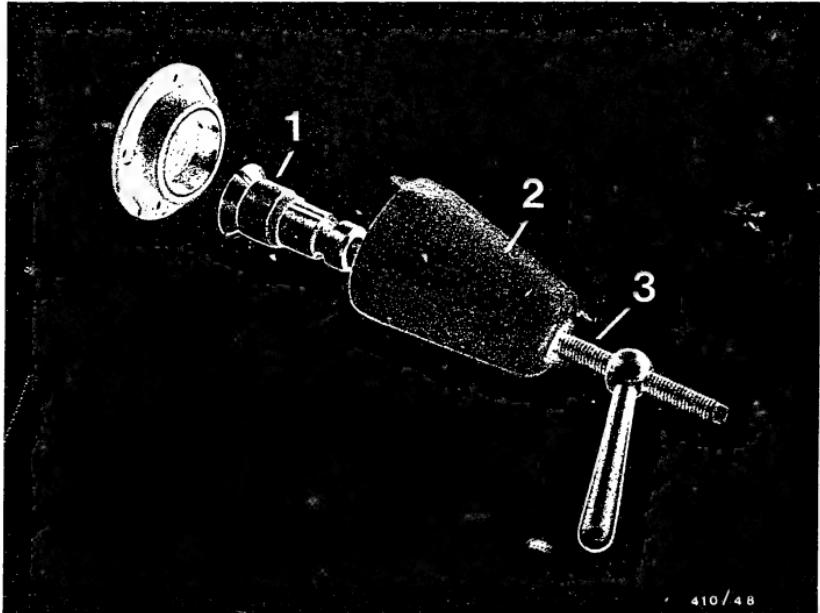
Slide retainer onto conical sleeve and, using force-piece, press retainer up to groove.

Remove assembly sleeve set and insert O-ring into lower annular groove on pump barrel.

D5

Assembling barrel-and-valve assys  
P-pump 0 410 ..





- 1 = Spring collet
- 2 = Puller bell
- 3 = Threaded pin

#### 11. Replacing the camshaft bearing

Remove bearing outer race in drive-end-bearing housing cover using spring collet, threaded pin and puller bell. Using a suitable mandrel under an arbor press, press out toward the inside the bearing outer race in the pump housing opposite the drive end.

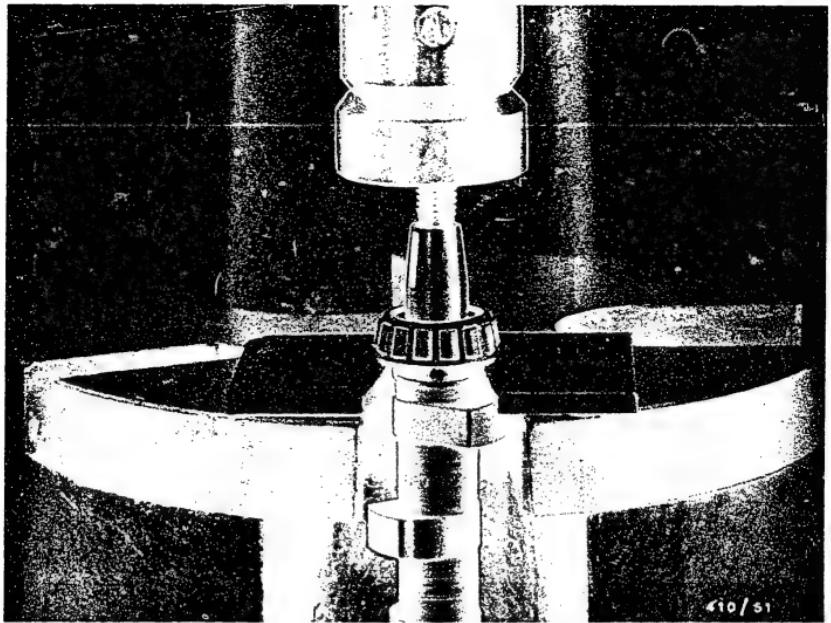
Note:

Use puller tools from tool board KDAW-T 100.

**D6**

Replacing the camshaft bearing  
P-pump 0 410 ..





Force off camshaft bearing using forcing plate KDEP 1580 under an arbor press.

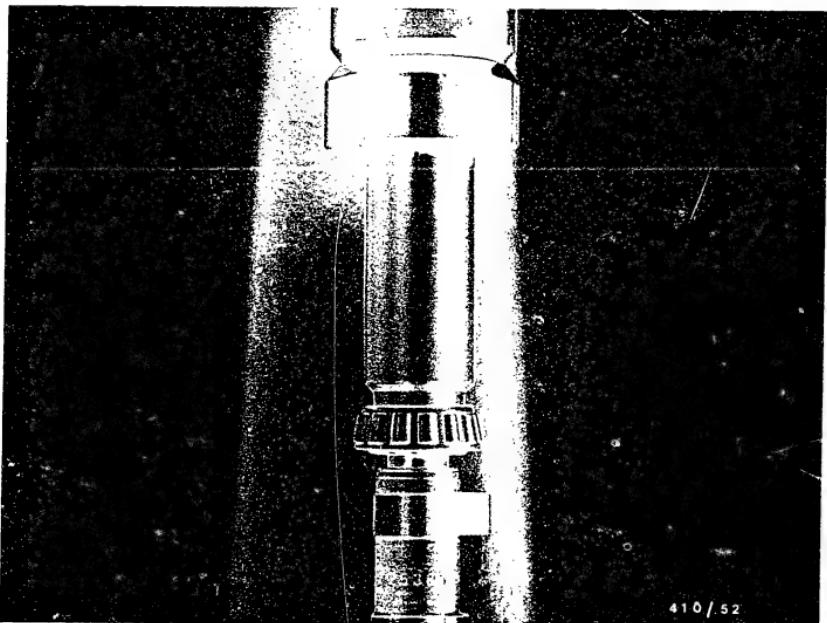
Note:

The forcing plate is suitable for all camshaft diameters. Slide camshaft into recess so that the bearing collar rests on both sides (see picture).

D7

Replacing the camshaft bearing  
P-pump 0 410 ..



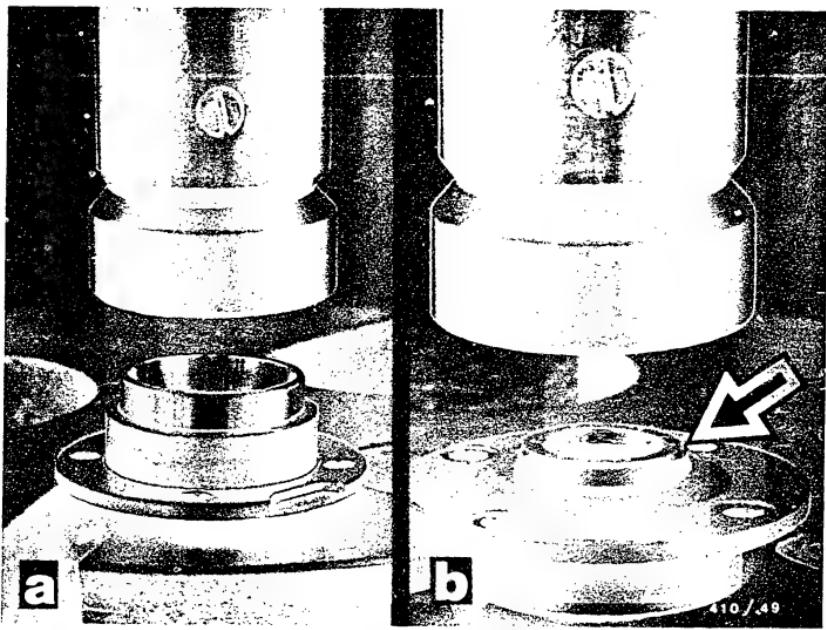


Press on new camshaft bearings under arbor press with press-on sleeve KDEP 1583 or KDEP 1582.

Note:

Press-on sleeve KDEP 1583 can be used for 25 and 30 mm cone diameters.

Press-on sleeve KDEP 1582 can be used for 17 and 20 mm cone diameters.



Press new bearing outer race into drive-end-bearing housing cover under an arbor press as far as the bearing seat (see picture a).

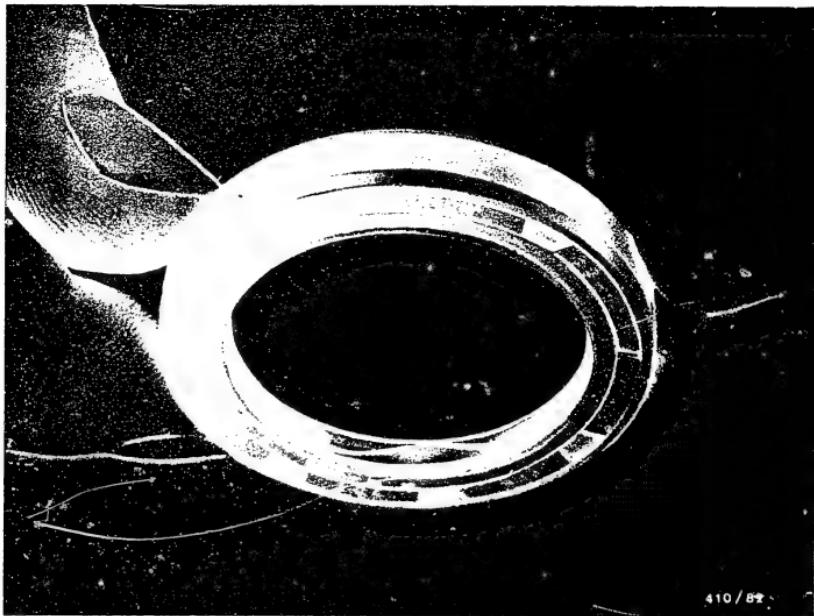
Lightly oil outside of new radial-lip-type oil seal and press in flush into drive-end-bearing housing cover (see picture b, arrow).

**D9**

Replacing the camshaft bearing

P-pump 0 410 ..





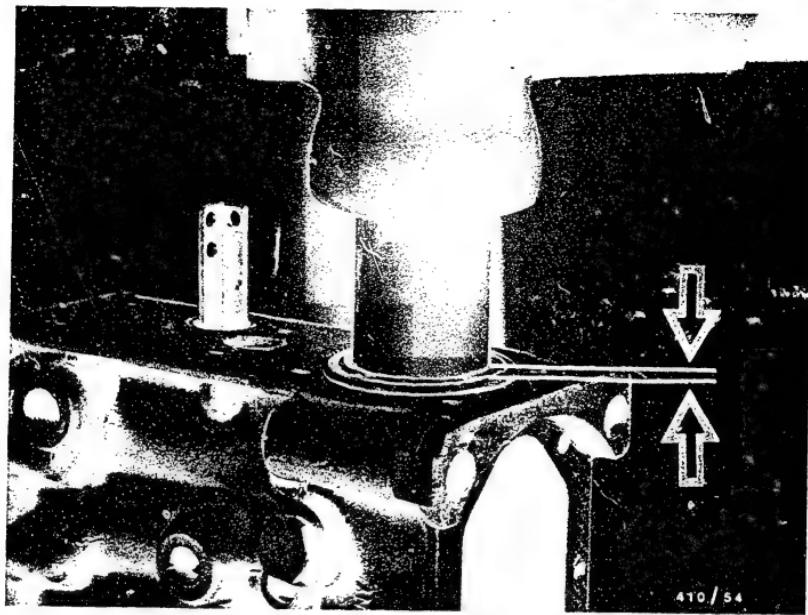
410 / 8\*

In the case of pump versions with a changing-helix seal ring, cone and sealing surface must be grease-free when inserting the camshaft.

**D 10**

Repairing the injection pump  
P-pump 0 410 ..





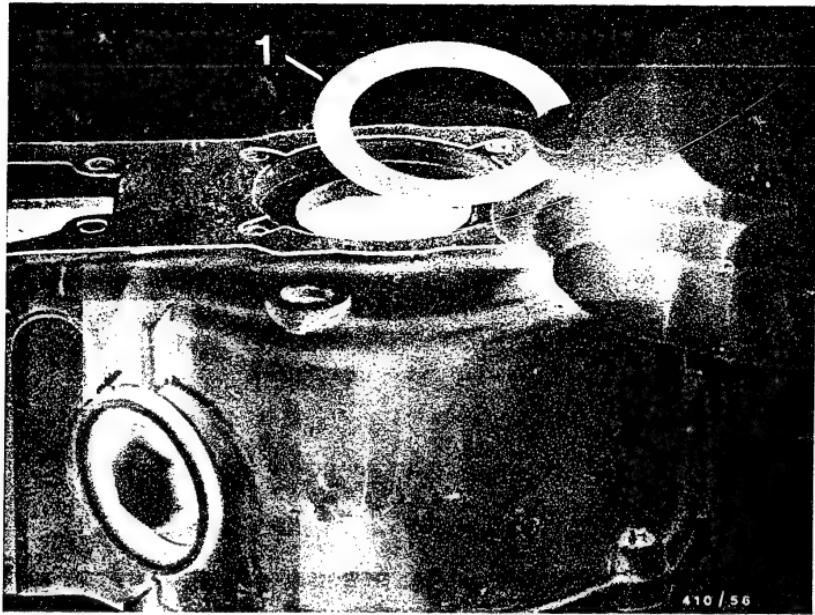
### 11.1 Presetting the projection dimension of the camshaft

Press in new outer race of tapered-roller bearing so that the projection dimension is approx. 3 mm (see picture, arrows).

**D11**

Setting camshaft projection dimension  
P-pump 0 410 ..





410 / 56

1 = Support ring

Insert the previously used support ring (the one removed) into the governor housing.

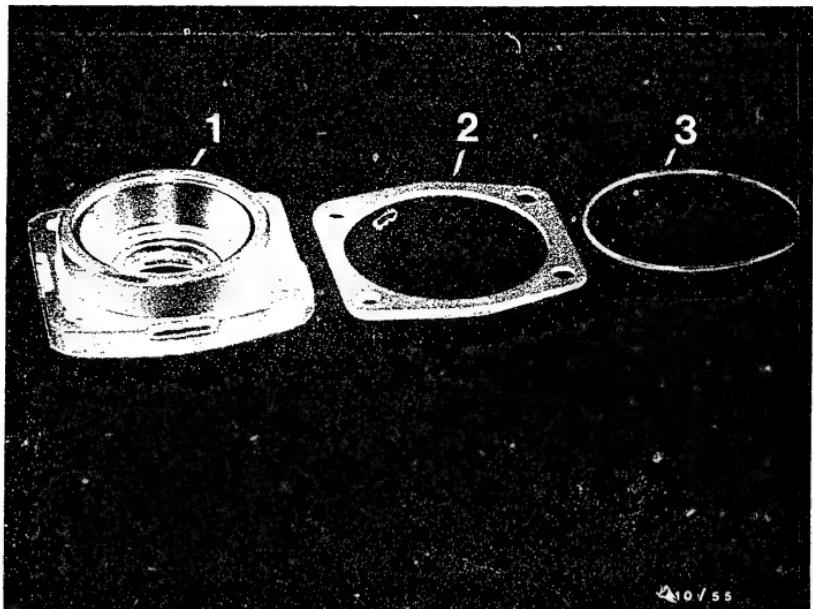
Mount governor housing with gasket on pump housing and fix with 4 fastening screws. Press in governor housing as far as it will go under an arbor press.

Tighten fastening screws to 7-9 Nm.

**D12**

Setting camshaft projection dimension  
P-pump 0 410 ..





410 / 55

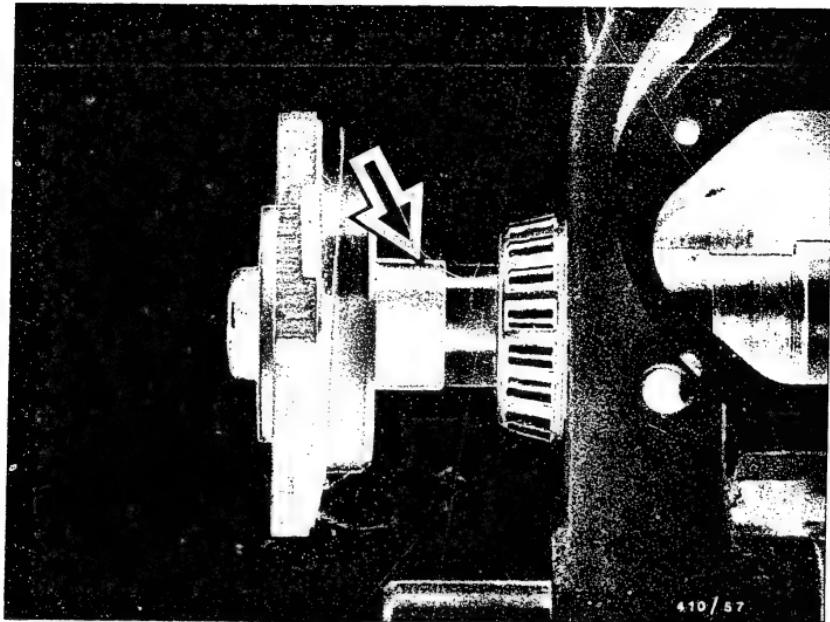
- 1 = Drive-end-bearing housing cover
- 2 = Shims
- 3 = O-ring

Introduce camshaft with tapered-roller bearing without intermediate bearing into camshaft chamber.  
Place shims without O-ring on drive-end-bearing housing cover.

**D 13**

Setting camshaft projection dimension  
P-pump 0 410 ..





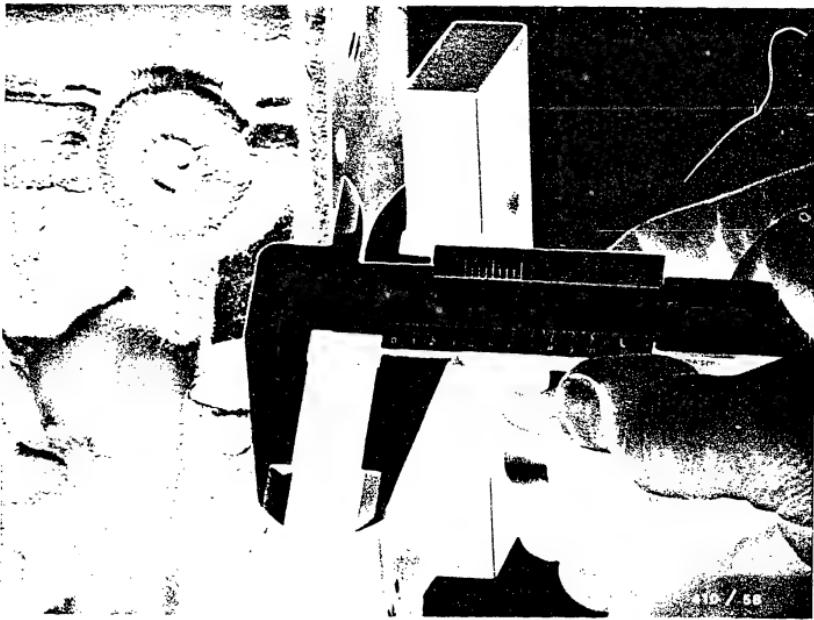
To protect the radial-lip-type oil seal, slide appropriate assembly sleeve onto camshaft (see picture, arrow).

Mount bearing end plate on pump housing with fillister-head screw and spring lock washer.

**D 14**

Setting camshaft projection dimension  
P-pump 0 410 ...





16 / 58

### 11.2 Establishing the projection dimension

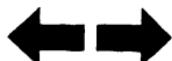
Press measuring strip KDEP 2899 for cone dia. 20 mm or  
KDEP 2971 for cone dia. 25 mm or  
KDEP 2924 for cone dia. 30 mm  
onto cone of camshaft.

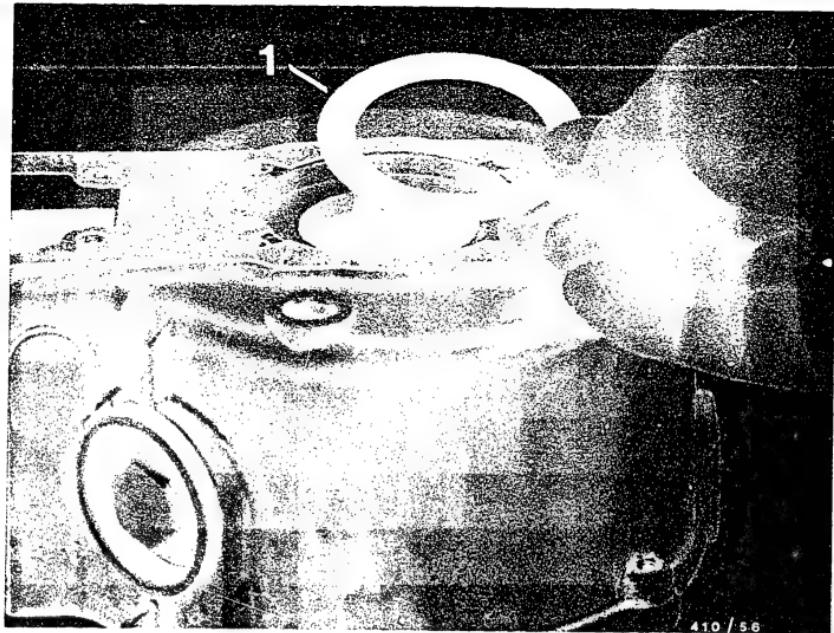
Using a calliper gauge, measure distance between  
measuring strip and pump housing (see picture).

Projection dimension should be  $13.8 \pm 0.5$  mm.

**D15**

Setting camshaft projection dimension  
P-pump 0 410 ..





If the measured projection dimension is, for example, smaller than the specified dimension, a thicker support ring must be installed in the governor housing in order to reduce the projection dimension of the tapered-roller bearing outer race in the pump housing. As a result, the camshaft is moved toward the drive-end-bearing housing. To do this, remove the drive-end-bearing housing cover, camshaft and governor housing.

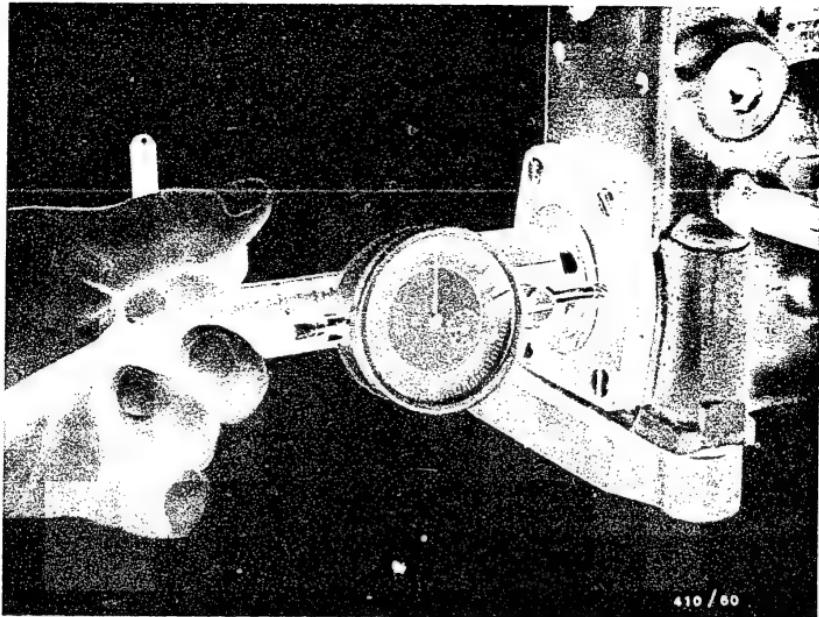
Mount governor housing with appropriate support ring as per service-parts list.

Press in governor housing as far as it will go.

Mount camshaft and drive-end-bearing housing cover (with assembly sleeve).

Check the projection dimension again with the appropriate measuring strip for the cone diameter.





410 / 60

## 12. Measuring and setting the axial clearance

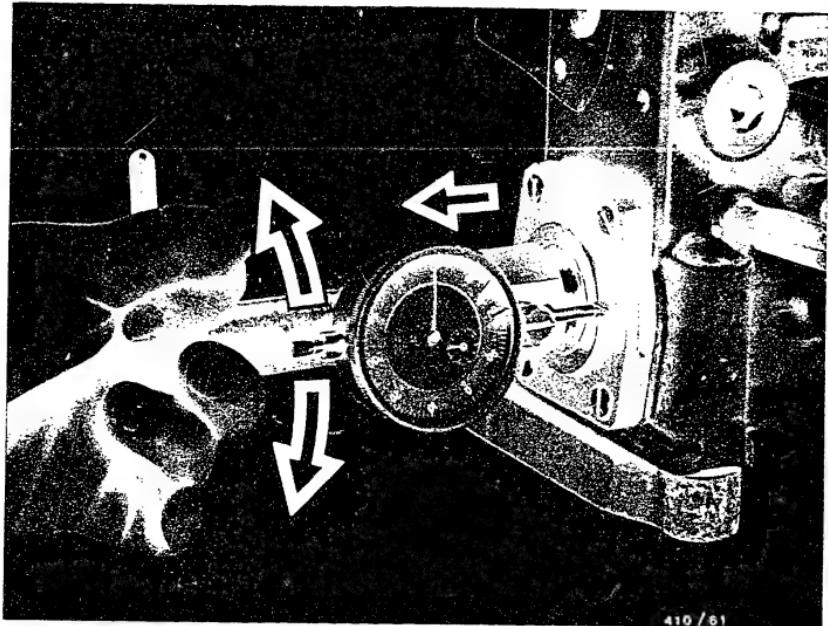
### 12.1 Measuring the axial clearance

Screw axial clearance measuring tool (depending on cone diameter of camshaft on drive end of pump) onto camshaft (see picture).

Insert dial indicator into mount provided on axial clearance measuring tool and preload by approx. 1 mm.

#### Note:

Measuring tool: KDEP 2927 for 20 mm cone or  
KDEP 2967 for 25 mm cone or  
KDEP 2882 for 30 mm cone



410 / 61

Pull camshaft axially with measuring tool, employing short, fast rotary movements (approx. 45°).

Release measuring tool.

Set dial indicator to 0.

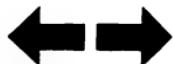
Then, employing the same rotational movements, press camshaft and release in same position in which dial indicator was set to 0.

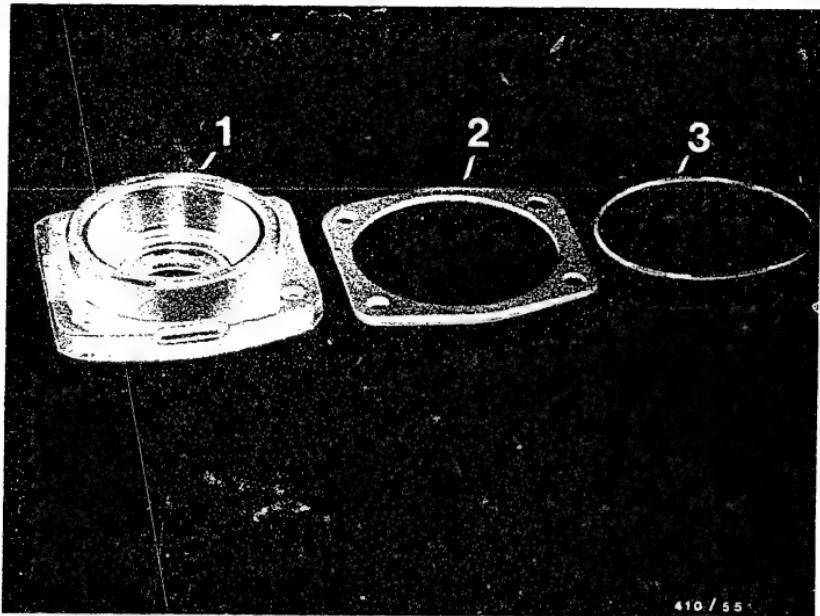
Read off axial clearance on dial indicator.

Axial clearance should be 0.02 ... 0.06 mm.

**D18**

Measuring and setting the axial clearance  
P-pump 0 410 ..





410 / 551

1 = Drive-end-bearing housing cover

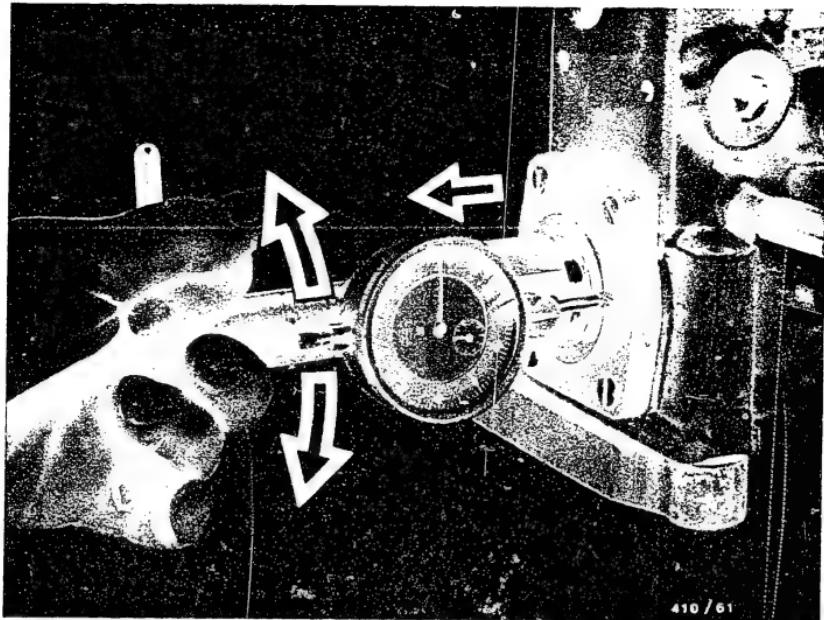
2 = Shim

3 = O-ring

### 12.2 Setting the axial clearance

If the axial clearance is not obtained, replace the shims under the drive-end-bearing housing cover with thinner or thicker shims.

To do this, remove the drive-end-bearing housing cover and insert appropriate shims. Slide appropriate assembly sleeve onto cone of camshaft. Re-mount drive-end-bearing housing cover (without O-ring) and screw down.



410 / 61

Screw axial clearance measuring tool onto cone of cam-shaft at drive end of pump (see picture).

Insert dial indicator into mount provided on axial clearance measuring tool and preload by approx. 1 mm. Pull camshaft axially with measuring tool, employing short, fast rotational movements (approx. 45°).

Release measuring tool.

Set dial indicator to 0.

Then, employing the same rotational movements, press camshaft and release in same position in which the dial indicator was set to 0.

Read off axial clearance on dial indicator.

Axial clearance should be 0.02 ... 0.06 mm.

### 13. Assembling the injection pump

Wet pump plungers before assembling with calibrating oil. Rub tallow into O-rings.

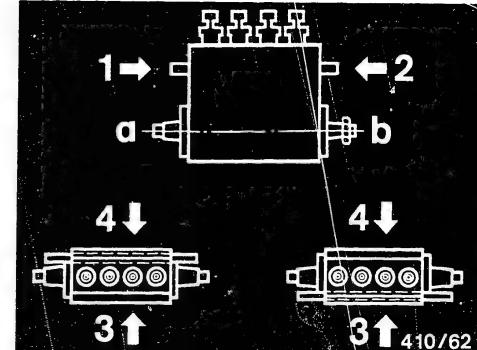
#### 13.1 Mounting numbers of type designation

The mounting number identifies the installation position of the camshaft and thus the injection sequence. It also states whether and in what position the governor, timing device and supply pump are mounted.



## Explanation of mounting numbers

Supply pump (mounting side and number)												Governor on pump side (1)	Timing device on pump side	Plunger helix			
mounted on: pump side 3 without 1 piece 2 pieces			pump side 4 1 piece 2 pieces			pump side 3 and 4 1 piece 2 pieces											
Shaft position (identified by notch at shaft end)																	
1	2	1	2	1	2	1	2	1	2	1	2	1	2	1			
100	200	300	400	500	600	700	800	900	1000								
101	201	301	401	501	601	701	801	901	1001								
102	202	302	402	502	602												
110	210	310	410	510	610												
112	212	312	412	512	612												
120	220	320	420	520	620	720	820	920	1020	1320	1520						
121	221	321	421	521	621	721	821	921	1021								



3,4=For pump sizes A,P,ZW,CW if cover at front and control rod at rear.

For pump sizes M,P7,P9 if control rod at front.

Example: 421

Injection pump with shaft position 2 and one supply pump on pump side 3, governor on pump side 2 and timing device on pump side 1.

On 2-cylinder injection pumps of size A the first digit of the mounting number identifies the angular cam spacing.

3... = 90° or 270° in shaft position 1;

4... = 180° in shaft position 2.

The mounting number may be followed by a code number for the mounting provisions for a supply pump, e.g.:

..../3= with mounting opening for supply pump, sealed by cover (without supply pump).

..../4= with 2 mounting openings, left-hand one with supply pump, right-hand one sealed by cover.

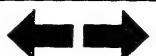
..../5= with 2 mounting openings, left-one sealed by cover, right-hand one with supply pump.

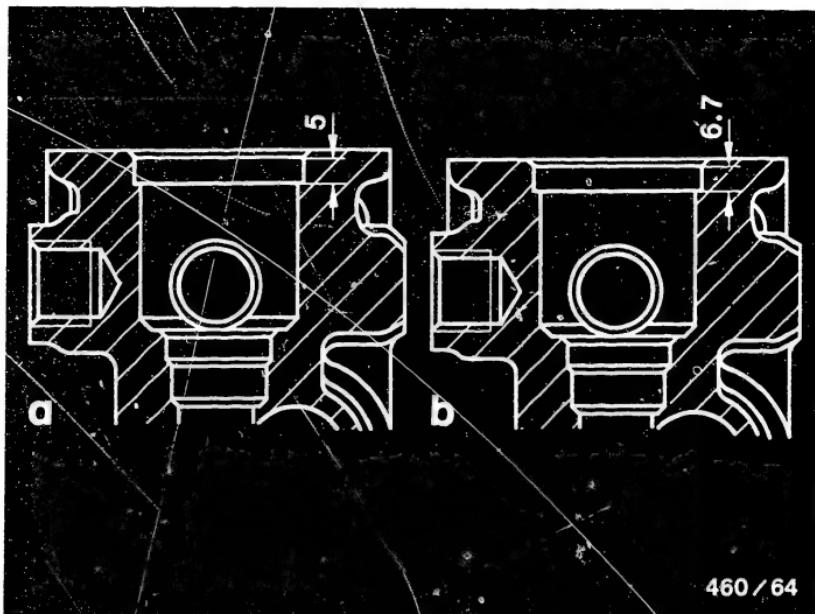
..../6= with 2 mounting openings, both sealed by covers (without supply pump).

..../7= with 2 mounting openings each on sides 3 and 4, right-hand mounting opening sealed by cover.

1) In the case of mounting numbers beginning with uneven numbers (300, 500, 700 etc.) with governor position 2, the entire injection-pump assembly is turned through 180°.

2) Notch stamped on P-pump only if cones at both camshaft ends identical, otherwise shaft position 1 given since on drive end either cone dia. 20 or 25 and on governor end always cone dia. 17.





## 13.2 Notes on housing modifications

### 13.2.1 Housing modifications

On pumps before FD 626 (June 76) the seat depth for the O-ring was 5 mm (picture a). On new housings as of FD 626 the seat depth is 6.7 mm (picture b). The O-ring is no longer supported by a nylon ring, but by a new stronger spacer ring made of sheet steel and, in some pumps, with accurately fitting Teflon support rings.

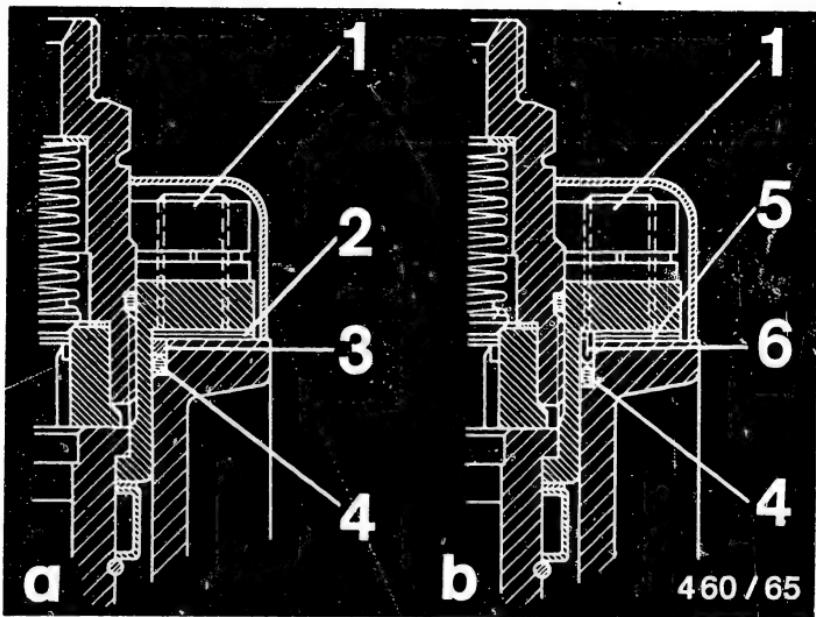
If ordering a replacement, please note that only housings of the new version are supplied in which barrel-and-valve assemblies of the previous version can still be used.

Some injection pumps used only by engine manufacturers in the USA have had the part numbers of the housings changed (see service-parts microfiche). Only new flange bushings may be used on such new housing types.

**E1**

Assembling the injection pump  
P-pump 0 410 ..





a = previous version

b = new version

1 = Threaded pin

2 = Shim plate (prestroke setting)

3 = Spacer ring (nylon ring)

4 = O-ring

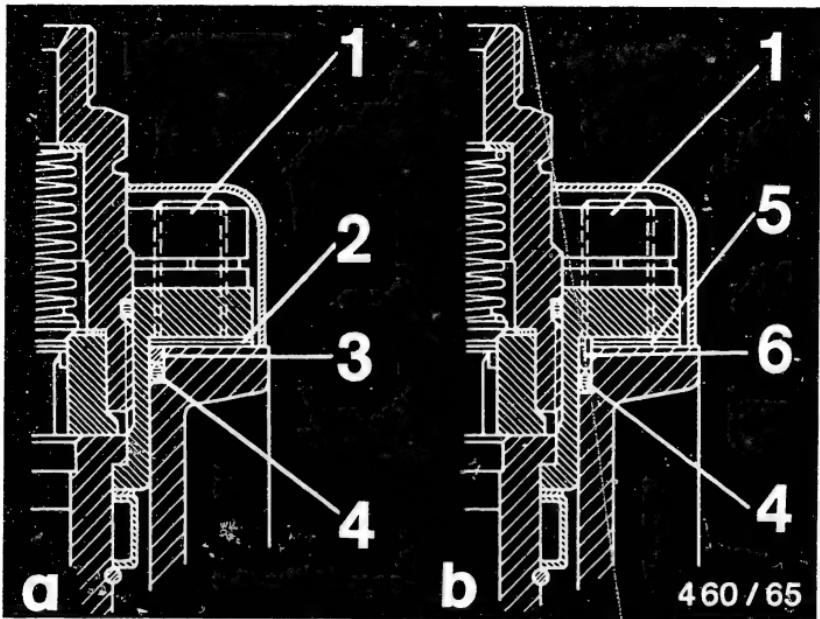
5 = Split prestroke shim

6 = Flange bushing with pressed-on spacer ring

### 13.2.2 Modifications to prestroke shims

Split prestroke shims are used on all P-pumps as of FD 626 (June 76).

Shim plates are still used for old housings. It is not permissible to install split prestroke shims accompanied by spacer rings (nylon rings) of the old version.



a = previous version

b = new version

1 = Threaded pin

2 = Shim plate (prestroke setting)

3 = Spacer ring (nylon ring)

4 = O-ring

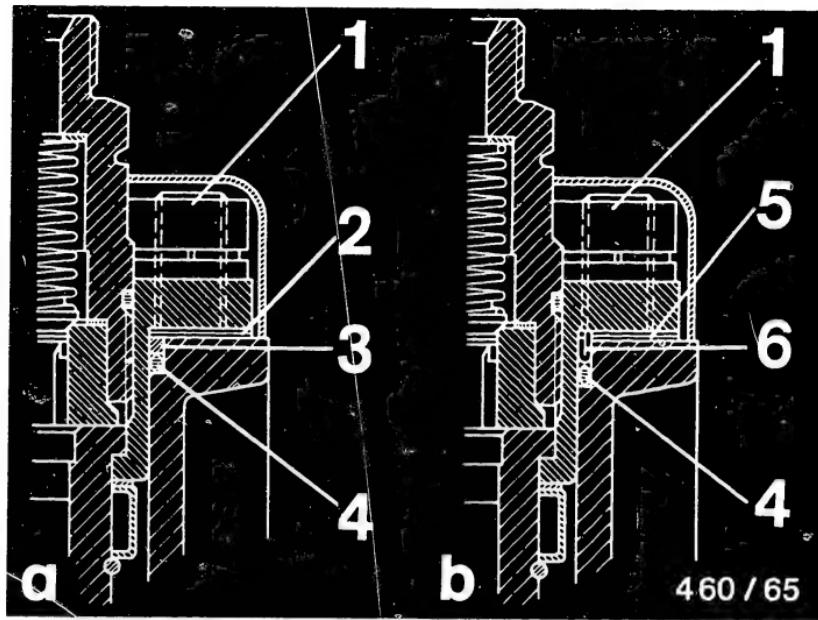
5 = Split prestroke shim

6 = Flange bushing with pressed-on spacer ring

### 13.2.3 Modifications to spacer ring and flange bushings

The spacer ring (nylon ring) is retained for housings of the old version. The new U-shaped spacer rings are pressed onto the new flange bushing.

New flange bushings are supplied only as a complete unit with U-shaped spacer rings already pressed on. Always install flange bushings as per service-parts list.



a = previous version

b = new version

1 = Threaded pin

2 = Shim plate (prestroke setting)

3 = Spacer ring (nylon ring)

4 = O-ring

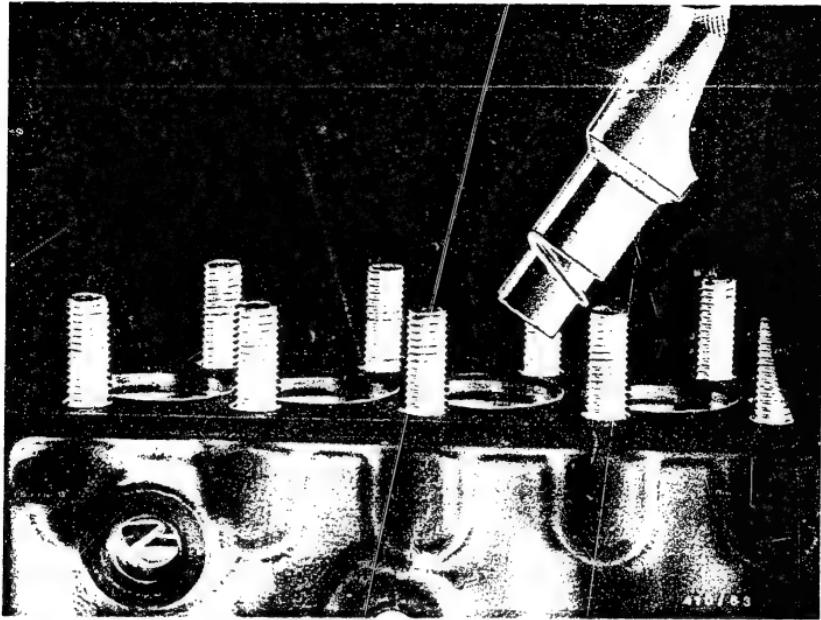
5 = Split prestroke shim

6 = Flange bushing with pressed-on spacer ring

#### 13.2.4 Modifications to threaded pin

Always use new threaded pins on old and on new housings. No components of the new version, with the exception of the threaded pins, may be installed in housings before FD 626 (June 76) with 5 mm seat depth.

Service parts of the old and new versions can be used together in housings as of FD 626 with 6.7 mm seat depth.



### 13.3 Installing the flange-bushing plunger-and-barrel assembly

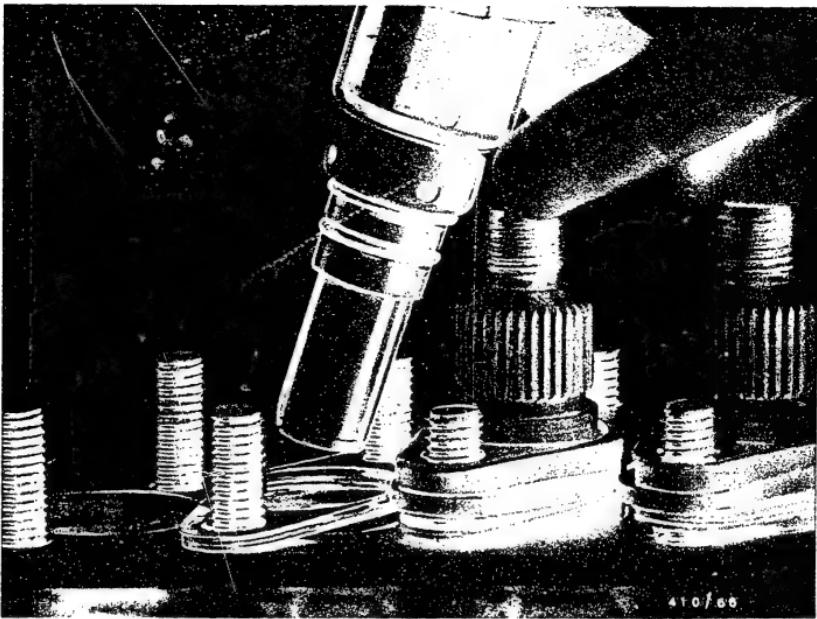
Remove the drive-end-bearing housing cover. Remove the camshaft.

#### 13.3.1 Inserting the lower O-rings

Using insertion device KDEP 2884, insert the lower O-ring (as per service-parts list) of the flange-bushing plunger-and-barrel assembly. Rub tallow into O-ring. Depress the ram of the device and slip the O-ring onto the projection sleeve (see picture). Insert device and release ram.

Note:

Do not mount O-ring by slipping onto flange-bushing plunger-and-barrel assembly together with barrel-and-valve assembly.  
O-ring will be damaged.



410/68

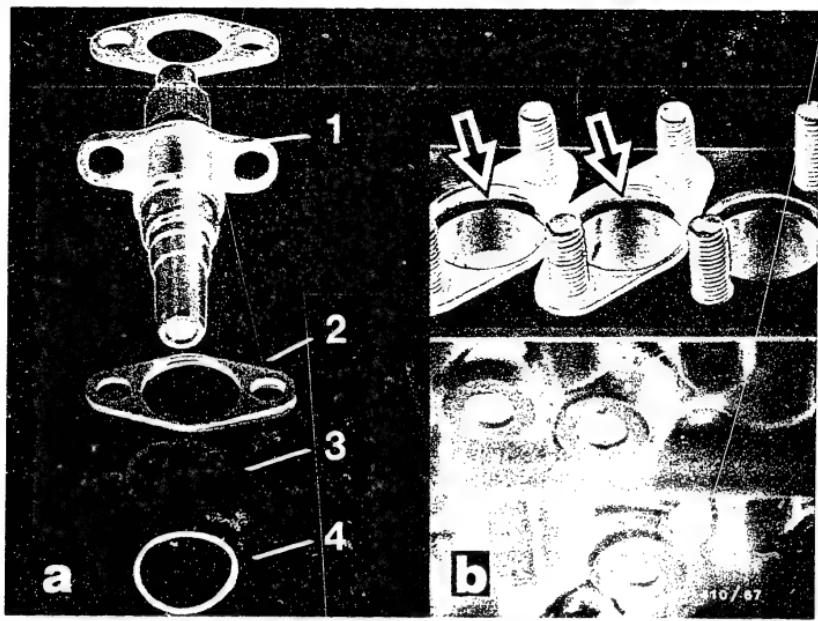
### 13.3.2 Inserting the flange-bushing plunger-and-barrel assembly (Series P..1/P..1000/P..3000)

Notches of flange bushings point in direction of control rod (back of pump) when inserting.

Note:

Use only the correct O-ring as per service-parts list for the respective pump version (different diameters, 28 and 30 mm).

Rub tallow into O-rings.



1 = Flange bushing

2 = Prestroke adjusting shims (1 or 2 part)

3 = Spacer ring

4 = O-ring

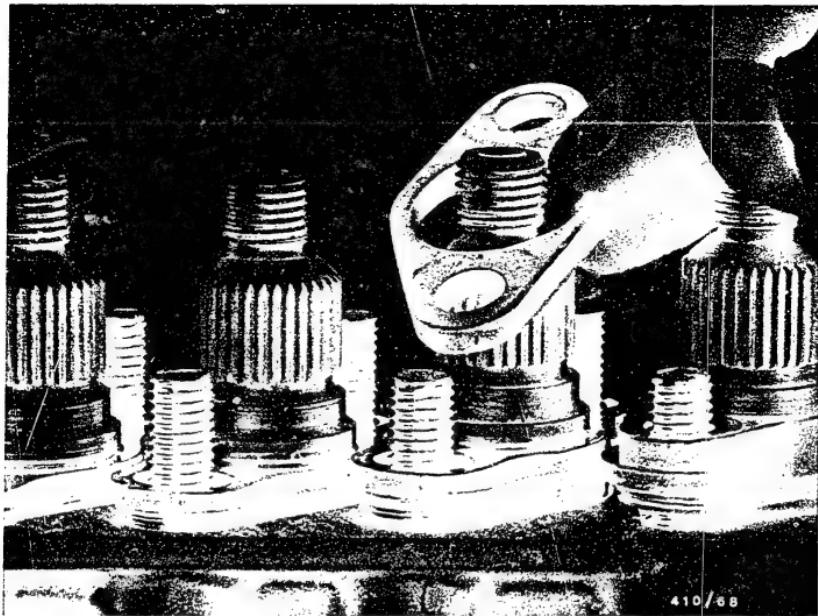
If O-rings of 28 mm diameter are used, slip prestroke adjusting shims, spacer ring and O-ring onto flange bushing of barrel-and-valve assembly and insert barrel-and-valve assembly (see picture a).

If the large O-ring (30mm diameter) is used, insert O-ring and spacer ring into pump housing before installing the barrel-and-valve assembly (see picture b, arrows). Put on the prestroke adjusting shims (see picture b).

If, when inserting the barrel-and-valve assemblies, major resistance can be felt, check the position of the O-rings.

Do not use force to press in the barrel-and-valve assembly. So as not to shear off any of the O-rings, move the barrel-and-valve assembly in the area of the slots by employing light pressure from above with the aid of box wrench KDEP 2997. Then turn the barrel-and-valve assemblies so that the stay bolts are in the center of the slots.



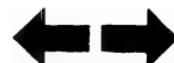


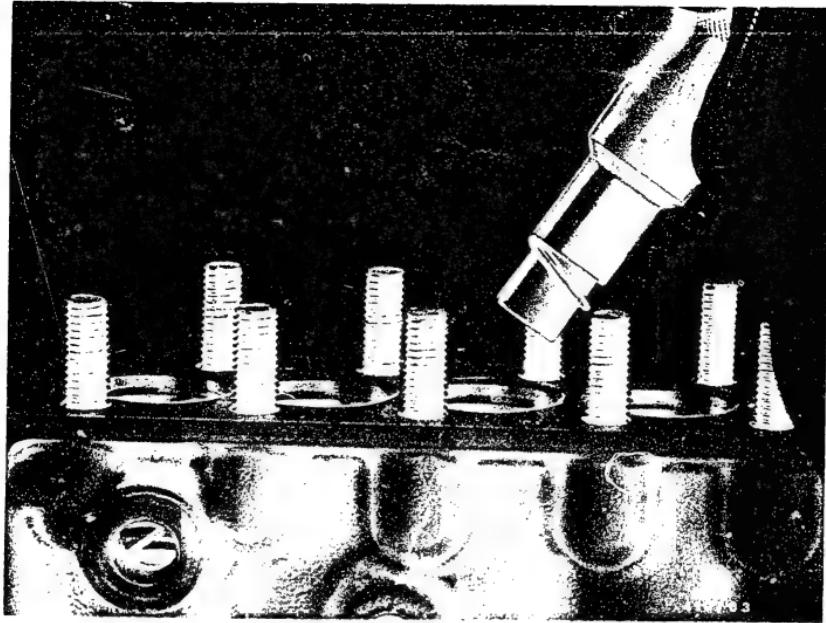
410 / 68

Put on pressure plates and spring lock washers.  
Screw on hexagon nuts and tighten to a torque of 40...  
45 Nm.

**E9**

Assembling the injection pump  
P-pump 0 410 ..





### 13.4 Installing the flange-bushing plunger-and-barrel assembly

Remove the drive-end-bearing housing cover. Remove the camshaft.

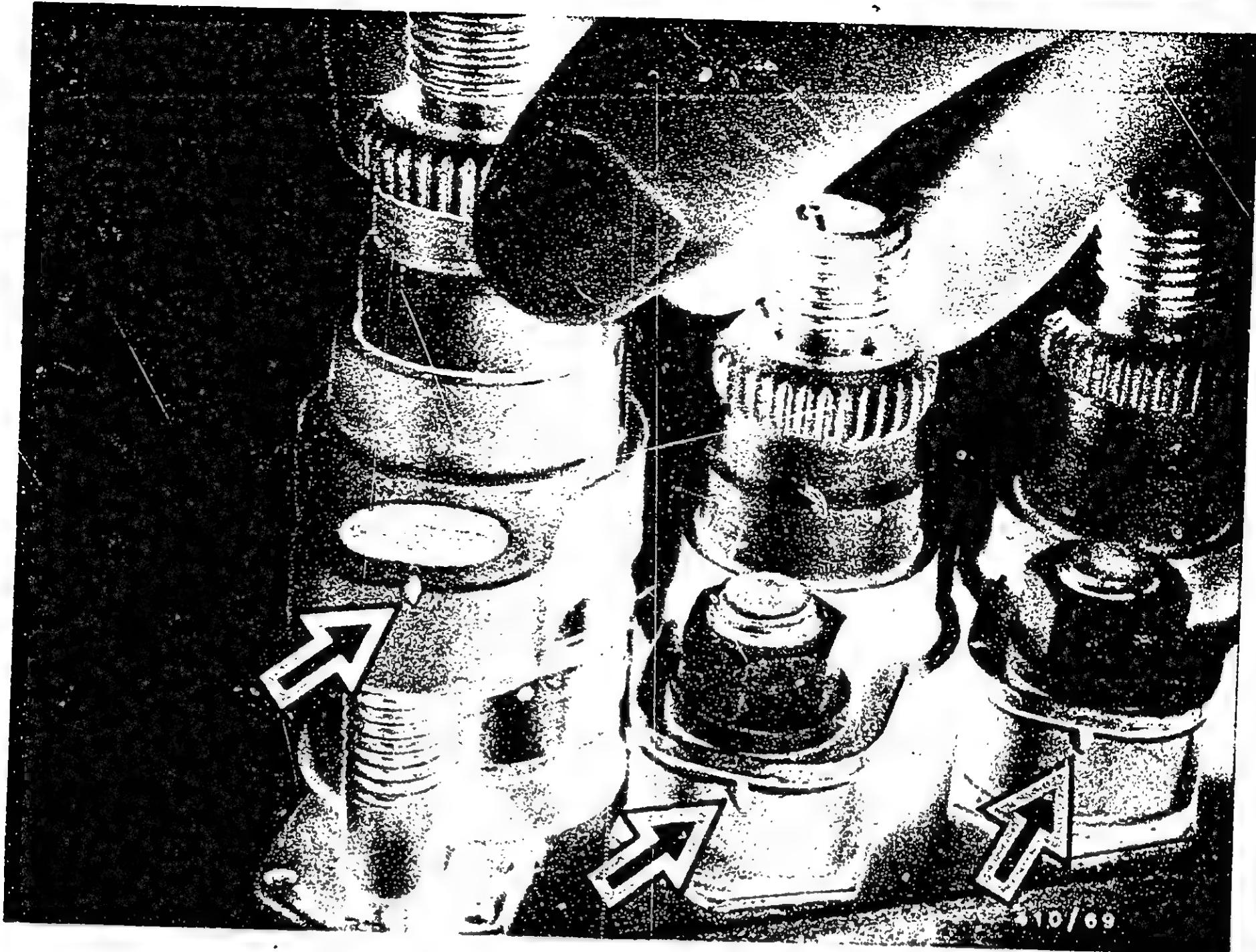
#### 13.4.1 Inserting the lower O-rings

Using insertion device KDEP 2884, insert the lower O-ring (as per service-parts list) of the flange-type plunger-and-barrel assembly. Rub tallow into O-ring. Depress the ram of the device and slip the O-ring onto the projection sleeve (see picture). Insert device and release ram.

Note:

Do not mount O-ring by slipping onto flange-bushing plunger-and-barrel assembly together with barrel-and-valve assembly.

O-ring will be damaged.



### 13.4.2 Inserting the flange-type plunger-and-barrel assembly

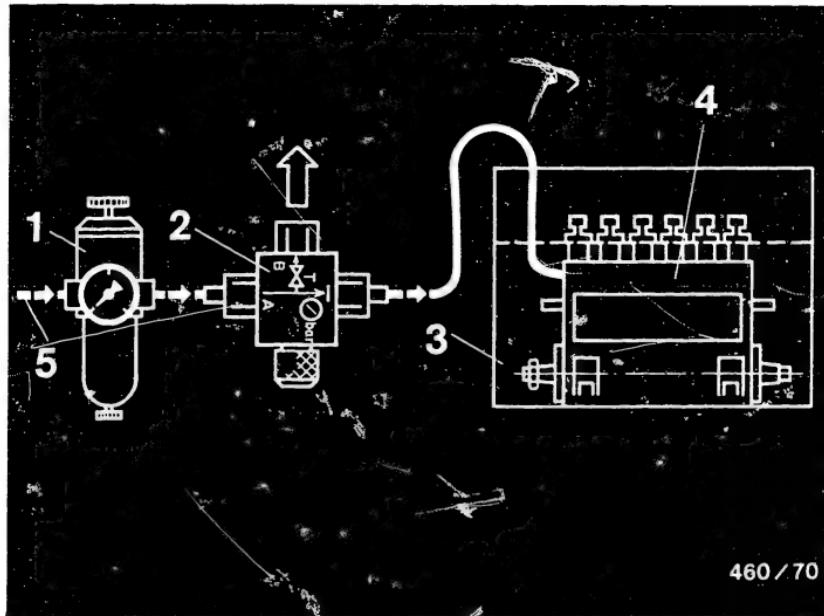
(Series P..6000, P..7000)

Using insertion device KDEP 2884, insert lower O-ring of flange-type plunger-and-barrel assembly. Insert flange-type plunger-and-barrel assembly so that the notches (see picture, arrows) point toward the control rod (back of pump). Do not use force to press in the barrel-and-valve assembly. Put on split prestroke shims and push in up to barrel. The thickness is stamped on the prestroke shims.

Note:

Use only 1 pair of prestroke shims of equal thickness for each barrel.

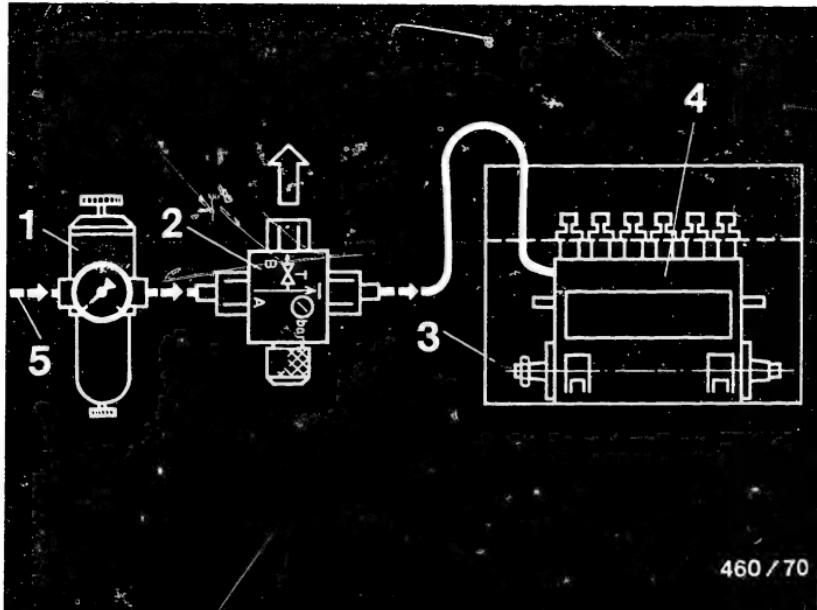
Turn the barrel-and-valve assemblies so that the stay bolts are in the center of the slots. Screw on hexagon nuts and tighten to 40...45 Nm.



- 1 = Pressure regulator with pressure gauge 0...6 bar and water trap
- 2 = Directional-control valve KDJE-P 100/1
- 3 = Immersion tank with calibrating oil
- 4 = Injection pump
- 5 = Compressed air

### 13.5 Leak test on suction gallery

Tilt pump. Wet pump plungers with calibrating oil and introduce into barrel-and-valve assemblies. Ensure freedom of movement. Screw holding mandrels KDEP 1560 or KDEP 1561 (depending on bore diameter) into locating bores. Remove Robo diaphragm, if applicable. Unscrew pump from clamping support. Connect pump to existing compressed-air supply system by way of a pressure regulator with water trap.



- 1 = Pressure regulator with pressure gauge 0...6 bar and water trap
- 2 = Directional-control valve KDJE-P 100/1
- 3 = Immersion tank with calibrating oil
- 4 = Injection pump
- 5 = Compressed air

To obtain the specified pressure reduction during the leak test, insert the directional-control valve KDJE-P 100/1 of pressure tester KDJE-P 100 into the compressed-air inlet (see picture).

For testing, immerse the pump vertically into the test bath. The openings of the delivery-valve holders must not be below the level of the calibrating oil.

Pivot the pump only in order to locate any existing leaks.

Test time and test pressure

8 minutes at 5 bar and then

1 minute pulsating 0 to 5 bar

Leaks in the region of the suction gallery are not allowable. Pay particular attention to leaks at the plunger-and-barrel assembly seats and O-ring seals.

This does not apply to leaks between barrel and plunger.

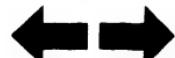
Take pump out of test bath and mount on clamping support.

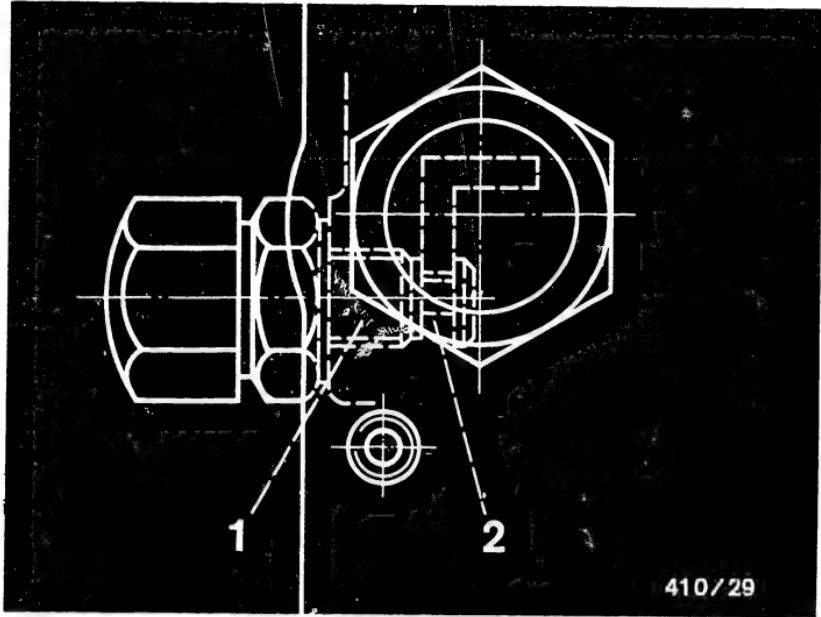
Remove holding mandrel.

Pull pump plunger out of barrel-and-valve assembly.

Note:

To prevent any skin irritation, grease your hands before testing with protective skin cream and wash with soap and water after testing is completed.



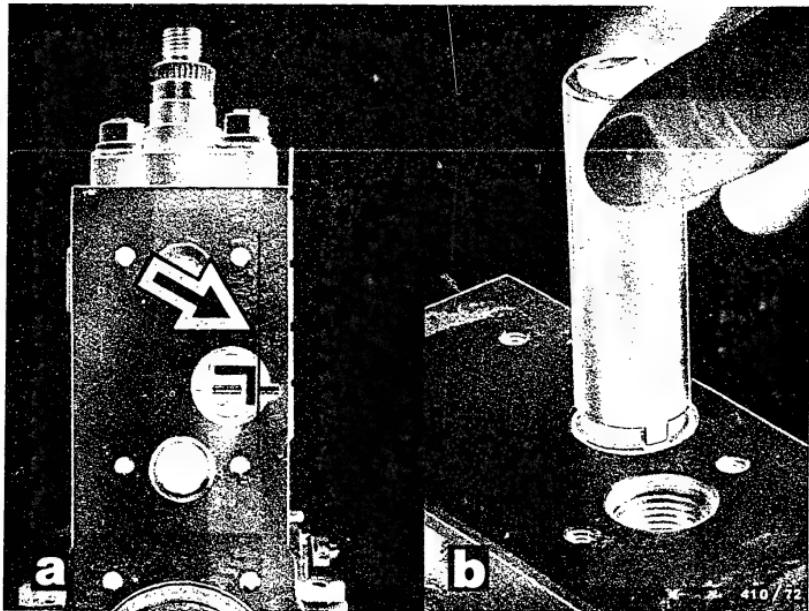


1 = Control rod guide screw

2 = Control rod guide

### 13.6 Inserting the control rod guide screw

Some 10 and 12 cylinder injection pumps have a control rod guide screw screwed into the center of the pump. Before introducing the control rod, screw the guide screw into the pump housing.



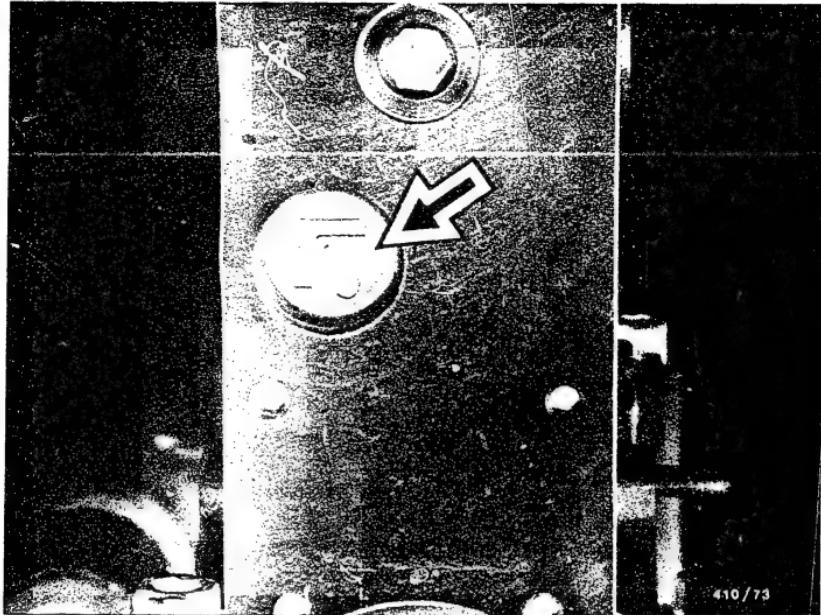
410 / 72

### 13.7 Installing the guide bushings and control rod

At the governor end, press in a new guide bushing (if necessary) with a suitable sleeve so that the vertical guide groove in the guide bushing is parallel to the pump housing (see picture a). Introduce the control rod. Insert straight pin into guide bushing. Screw in threaded ring with socket pin wrench KDEP 2970 and tighten to 30...40 Nm (see picture b).

Note:

On pump PESV..., only the longer control rod which is on the governor end has a slot for a straight pin.

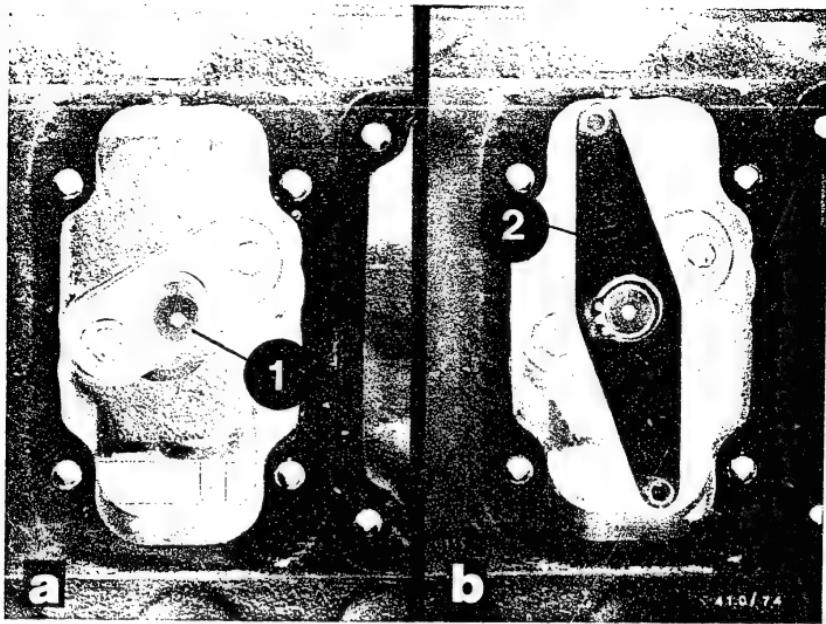


410/73

At the drive end, insert guide bushing (see picture, arrow) over control rod into housing (guide bushing does not have a tight fit). Screw in screw plug with seal ring and tighten to 30...40 Nm.

Check whether control rod moves freely.

If applicable, adjust control rod guide screw so that control rod still moves freely. Tighten guide screw lock nut.



41.0/74

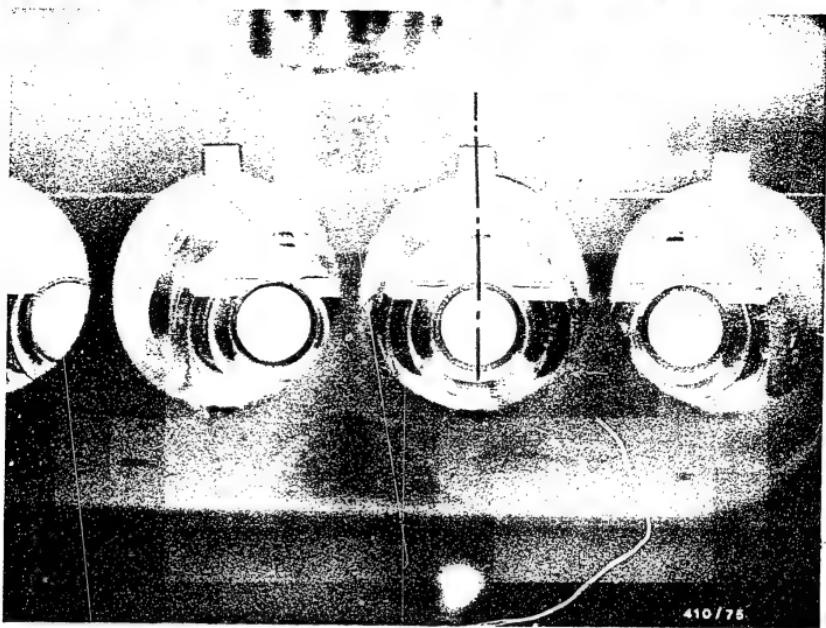
- 1 = Bearing pin for reverse-transfer lever  
 2 = Reverse-transfer lever

On PESV pump, insert bearing pin for reverse-transfer lever and finger-tighten with both hexagon-socket-head cap screws (see picture a).

Insert reverse-transfer lever so that both pins engage the drivers in the control rods (see picture b).

Put retainer on bearing pin.

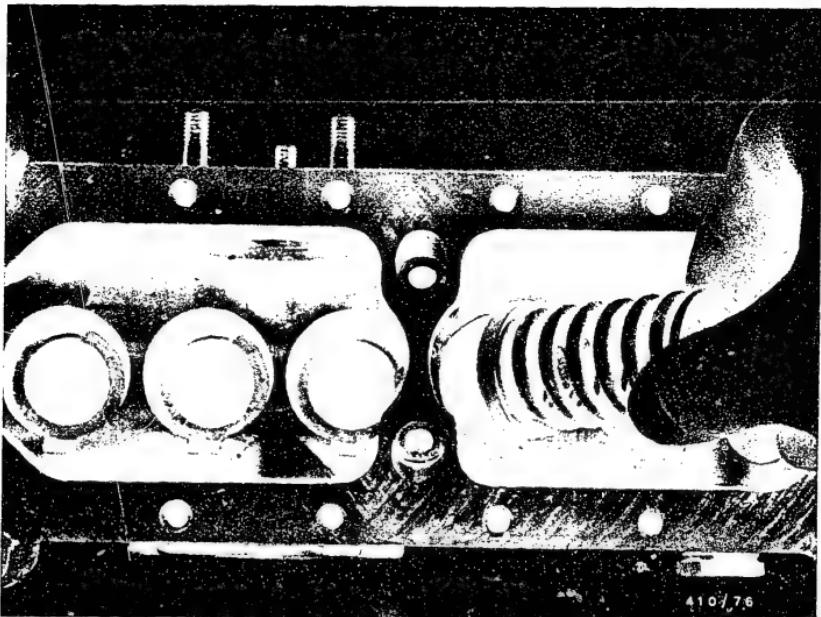
Adjust bearing pin with flange in region of slots so that control rods can move easily throughout entire adjustment range without sticking.



### 13.8 Inserting the control sleeves

Bring control rod into center position.

Driver slots in control rod for the control sleeves align with the roller-tappet guides in the pump housing. Using assembly tool KDEP 1071, insert control sleeve so that the driver balls of the control sleeves come into engagement with the driver slots of the control rod. Constantly check the control rod for freedom of movement when doing this.

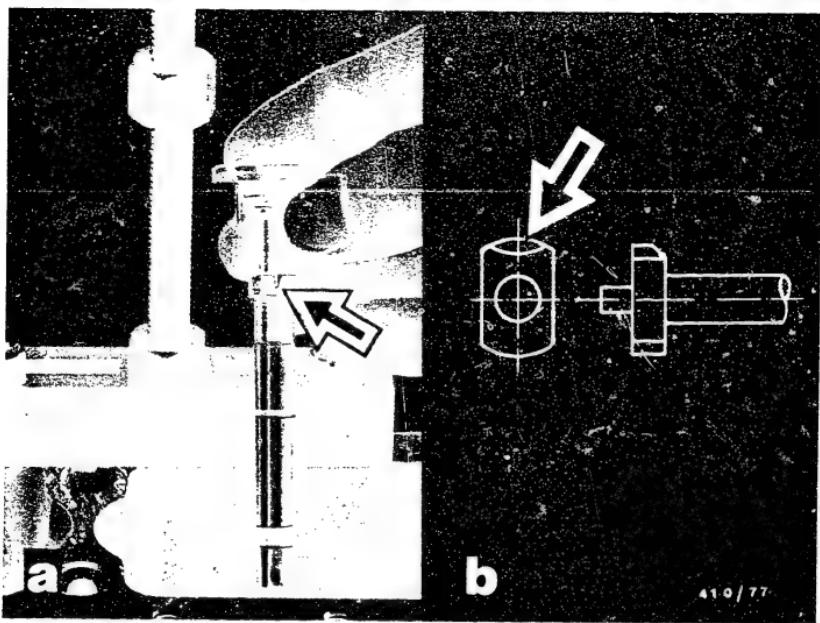


Using grease, stick compression spring into upper  
spring seat and then introduce into pump housing (see  
picture).

**E20**

Assembling the injection pump  
P-pump 0 410 ..





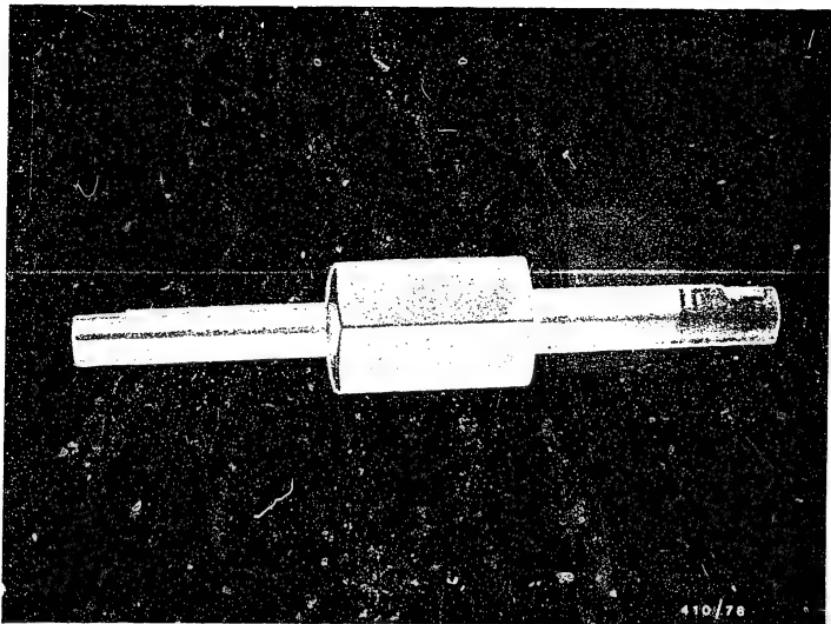
### 13.9 Installing the pump plunger

Mount assembly device KDEP 1505 or KDEP 2888 or KDEP 1067 -not shown- on pump housing. On PESV pumps, if using assembly device KDEP 1505, use the holding bracket KDEP 1505/1 with it. Hook in the lower spring seat at the base of the pump plunger (see picture a).

Introduce pump plunger into pump barrel so that the line mark (see picture a, arrow) at the base of the plunger points toward the control rod (back of pump).

Note:

In some cases, the line mark on the plunger control arm has been replaced by a ground flat (see picture b, arrow).



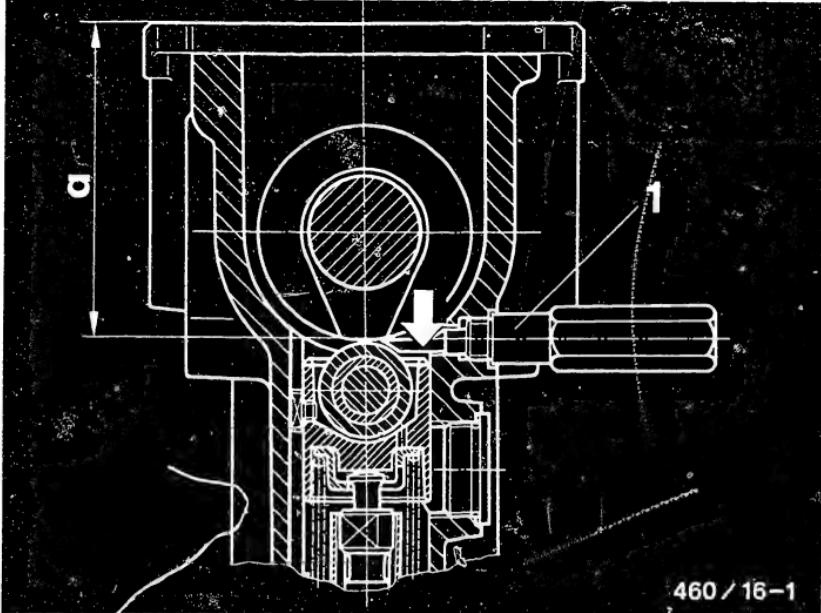
### 13.10 Installing the roller tappet

#### 13.10.1 Mounting with eccentric tappet holder KDEP 2910

for pumps without thread in locating bore

Introduce roller tappet into guide groove and press down with assembly device KDEP 2505.

Insert eccentric tappet holder KDEP 2910 (see picture) and press into TDC position by turning the roller tappet.



a = Gap

1 = Guide sleeve

### 13.10.2 Mounting with tappet holder KDEP 1041

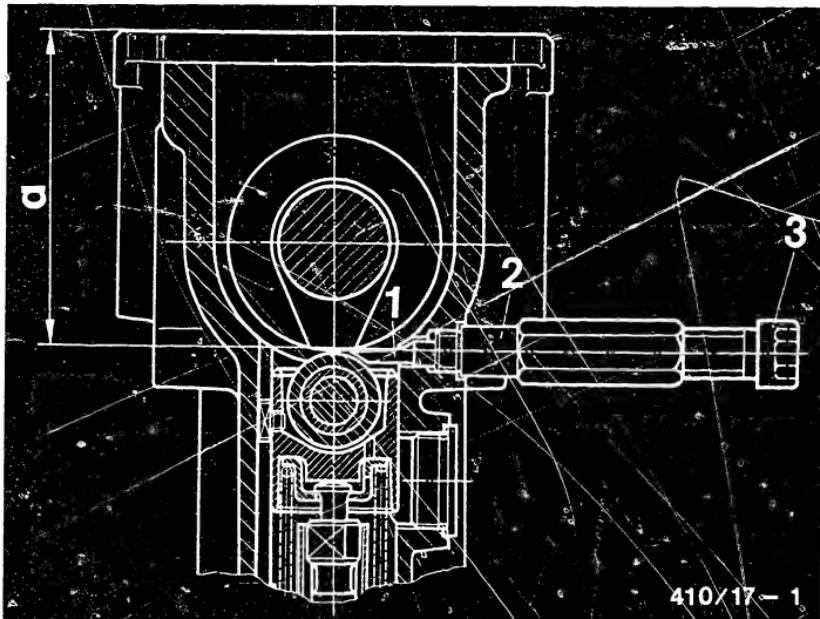
Introduce roller tappet into guide groove and press in with assembly device KDEP 1505 until tappet holder (see picture, arrow) can be introduced. Screw in guide sleeve as far as collar so that tappet holder is secured.

Using a depth gauge, check gap "a" from the seating surface of the base closing cover to the roller of the roller tappet.

- Pump versions ..S1,..S800,..S1000:

Gap min. 63 mm

This gap must be obtained on these pump versions without pressing with the hexagon-socket-head cap screw.



a = Gap

1 = Tappet holder

2 = Guide sleeve

3 = Hexagon-socket-head cap screw

- Pump version ..S3000, ..S6000 (11 mm lift)

Gap min. 64.2 mm.

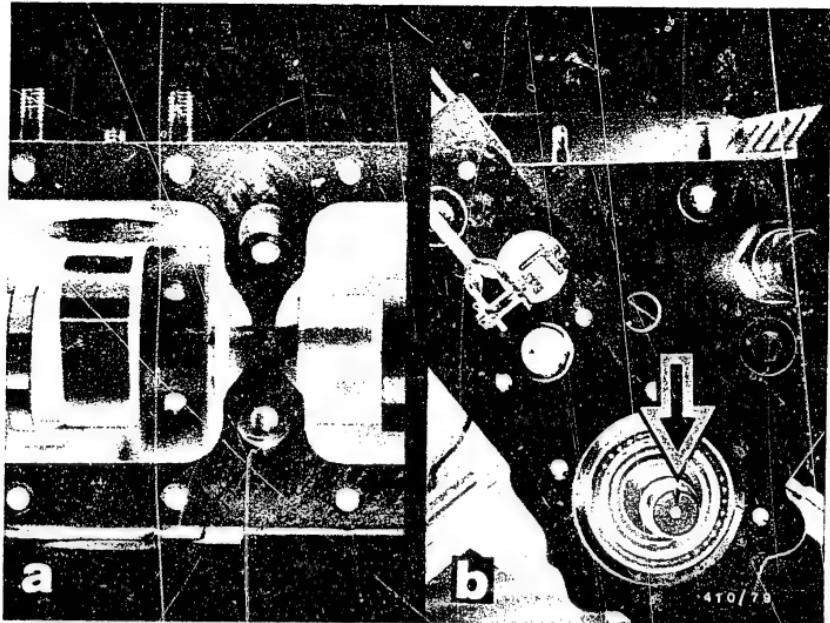
- Pump version ..S7000 (12 mm lift)

Gap min. 65.0 mm

To obtain these gaps, turn the hexagon-socket-head cap screw on tappet holder KDEP 1041.

Observe the installation dimension so that the camshaft can be installed and the tappet holders removed again.

Check the control rod for freedom of movement.



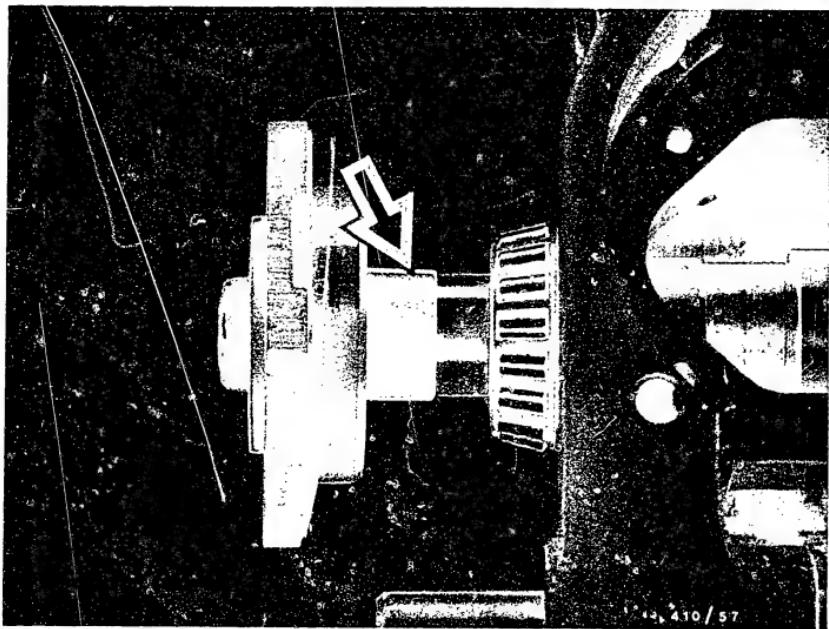
### 13.11 Installing the camshaft

From the drive end, introduce camshaft with intermediate bearing.

Note:

Notch marks on drive end of camshaft (see picture b, determining the position of the shaft) are not to be found on any P-camshafts which have different diameters at the shaft ends because the drive end is identified by the thicker shaft end.

The notch markings are still used on camshafts on which the shaft ends are identical.



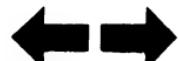
410 / 57

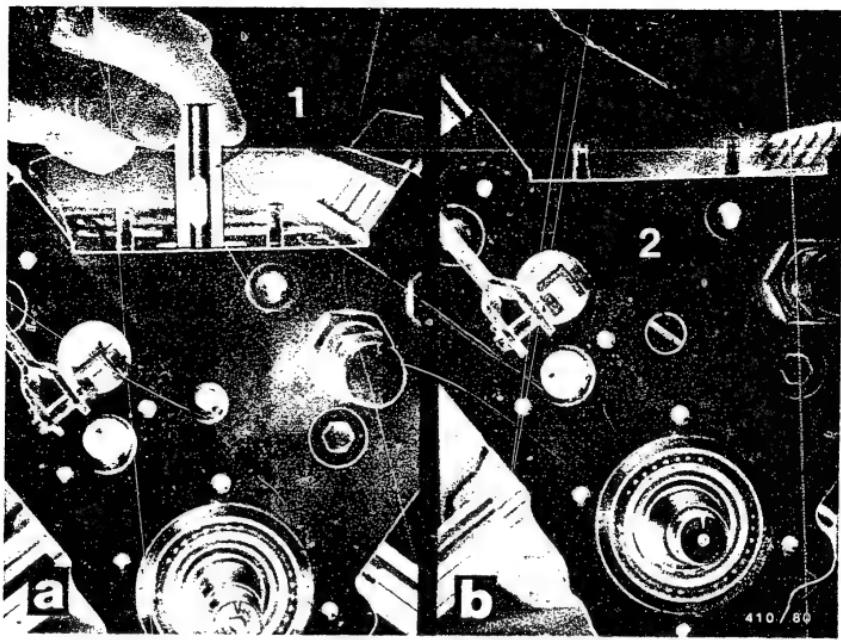
Screw down intermediate bearing with both hexagon-socket-head cap screws. Tightening torque 7-9 Nm. Slide appropriate mounting sleeve onto camshaft (see picture, arrow). Mount drive-end-bearing housing cover with shims and O-ring. Tighten fillister-head screws of drive-end-bearing housing cover to 7-9 Nm and hexagon-socket-head cap screws to 10-12 Nm.

Mount drive coupling on camshaft. Hold with holding wrench KDEP 2906 or KDEP 2885.

**F2**

Assembling the injection pump  
P-pump 0 410 ..





1 = Roller tappet

2 = Guide screw

Note on injection pump PESV:

Insert roller tappet for supply pump drive and fix with guide screw.

**F3**

Assembling the injection pump

P-pump 0 410 ..



### 13.12 Removing the tappet holder

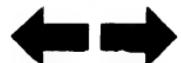
#### - Tappet holder KDEP 2910:

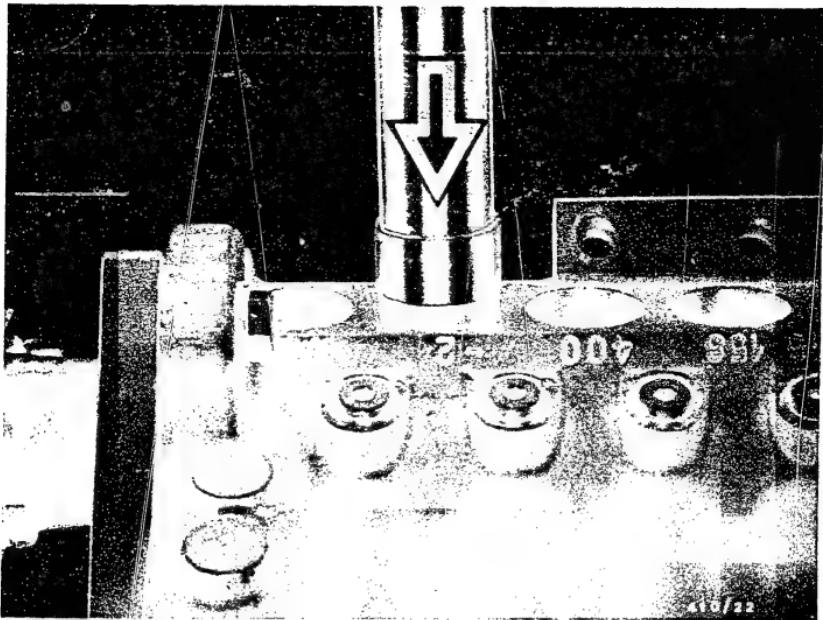
Turn eccentric of tappet holder through 180°.  
Turn camshaft until cam lobe raises the roller tappet.  
Remove tappet holder.  
Check control rod for freedom of movement.

#### - Tappet holder KDEP 1041:

Loosen guide sleeve or hexagon-socket-head cap screw.  
Turn camshaft so that the highest cam lobe raises the roller tappet.  
Remove tappet holder.  
Check control rod for freedom of movement.

Put on base closing cover with gasket and tighten fastening screws to 6-7 Nm.



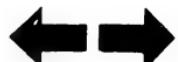


On PESV pumps, knock in new base end covers using press-in mandrel KDEP 1574 (see picture).

**F5**

Assembling the injection pump

P-pump 0 410 ..



### 13.13 Leak test on camshaft spring chamber and governor interior

Completely assemble the pump.

The compressed air required for the leak test should be introduced into the camshaft chamber at a suitable place (e.g. oil inspection bore). Immerse pump vertically in test bath. The delivery-valve holders must not be below the level of the calibrating oil.

Test time and test pressure

7 minutes at 1.5 bar, and then  
1 minute at 0.5 bar.

By means of visual examination, check whether there are leaks at any of the joints, connections, seal rings and end covers on housing and cover.

No air bubbles may be visible.

- Note:  
To prevent any skin irritation, grease your hands with protective skin cream and wash with soap and water after testing is completed.

Set the injection pump on the pump test bench.



# After-sales Service

## Technical Bulletin

Only for use within the Bosch organization. Not to be communicated to any third party.

40...46, 58

MODIFICATION TO THE DELIVERY-VALVE HOLDER  
OF FUEL-INJECTION ASSEMBLIES  
0 401 846.., ..848.., ..875..,

VDT-I-401/102 En

8.1983

In the following fuel-injection pumps, which are fitted in Mercedes-Benz coaches and commercial vehicles with naturally-aspirated engine, the delivery-valve holder 2 413 371 118 (with return throttle) has been changed to 2 413 371 090 (without return throttle) as from date of construction FD 344:

Fuel-injection pump	Fuel-injection assembly
PE 6P 110A 320 LS 3805	0 401 846 738
	.. 739
	.. 740
	.. 748
	.. 749
	.. 755
	.. 756
	.. 762
	0 401 876 717
PE 6P 110A 320 LS 3814	0 401 846 741
	0 401 876 723
PE 8P 110A 320 LS 3802	0 401 848 708
	.. 712
	.. 737
	.. 738
	.. 739
PE 8P 110A 320 LS 3802-1	0 401 848 751
	.. 752
PE 8P 110A 320 LS 3813	0 401 848 740

Delivery-valve holder 2 413 371 090 can be recognized by its short form, 57 mm high compared with delivery-valve holder 2 413 371 118 which is 68.5 mm high.

The service-part lists for the relevant fuel-injection pumps will be amended accordingly.

For test specifications see the relevant microcards WP ..

**BOSCH**

Geschäftsbereich KH Kundendienst, Kitz-Ausstattung  
© by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50, Printed in the Federal Republic of Germany.  
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH.

N1

Technical Bulletins

P-pump 0 410 ..



# After-sales Service

## Technical Bulletin

Only for use within the Bosch organization. Not to be communicated to any third party.

40 ... 46, 58

LOOSE BEARING END PLATES AND DAMAGE TO  
BEARINGS IN PE..P..S FUEL-INJECTION PUMPS  
(SERIES 3000) FROM MERCEDES-BENZ COMMERCIAL  
VEHICLES WITH ENGINE OM 42.. 0 411... .

VDT-I-410/105 En  
11.1983

Cases have been reported of loose bearing-end-plate screws and damage to bearings in the above mentioned fuel-injection pumps (up to date of manufacture FD 343).

If such fuel-injection pumps can be ascertained as having loose fastening screws or bearing end plates, the following procedure is to be adopted:-

- Make a visual check of the bearing end plate seat in the housing for wear. Replace the pump housing with the damaged seat.
- Use a screw tap to free the threads of the fastening screws in the pump housing from adhesive remains. Repair damaged threads by means of screw-thread inserts.
- Replace bearing end plates, port-closing indicators, fastening screws and washers with the following new parts:-

Part No.	Designation	No. of items
2 415 551 072	Bearing end plate	1
2 914 559 101	Hexagon-socket-head-cap screw	4
2 410 113 006	Seal ring	4
2 411 331 038	Indicator	1
2 916 693 005	Spring lock washer	2
2 911 061 191	Hexagon screw M 6 x 10	2

- The tightening torque for the hexagon-socket-head-cap screws is 10 - 12 Nm.
- When repairing pumps with damage to the bearings on the governor or drive side, you should also use the new parts listed (see microfiche for bearings). When repairs have been completed, you should check the port-closing marking and correct it if necessary.

During the warranty period, repairs will be carried out free of charge. After this period a fair deal application must be made.



**BOSCH**

Geschäftsbericht KH Kundendienst Kitz-Ausarbeitung  
© by Robert Bosch GmbH, D-7 Stuttgart, Postfach 50 Printed in the Federal Republic of Germany.  
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH.

N2

Technical Bulletins

P-pump 0 410 ..



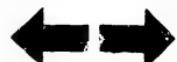
The damaged parts which have been removed should be sent for examination  
with form G 20 and delivery slip KH/VKD 3 - 15 333 (from abroad form G 21)  
to:

Robert Bosch GmbH  
K 5 / QSG  
Am Boschwerk  
7000 Stuttgart 30  
West Germany.

N3

Technical Bulletins

P-pump 0 410 ..



# After-sales Service

## Technical Bulletin

Only for use within the Bosch organization. Not to be communicated to any third party.

40...46, 58

VDT-I-400/109 En

2.84

### TESTING FOR LEAKS ON IN-LINE FUEL-INJECTION PUMPS

Supersedes Ed. 5.1981

Due to more stringent requirements, and as a result of the latest knowledge gained in this field, the following points are to be noted when carrying out the seal testing on the M, MW, .. and P-size in-line fuel-injection pumps.

#### 1. Test conditions

Only clean, clear calibration oil as per ISO-4113 is to be used for testing. The submersion tank is only to hold sufficient oil for the injection pump to be covered completely. The calibration-oil temperature is to be at least +20 °C. The submersion\* tank must be designed and constructed so that every point in it can be easily seen. This is achieved by taking the following steps:

- the tank is to be painted a light color on the inside
  - illumination is to be provided in the tank
- calibration oil is to be as clear as possible.

A water separator is to be provided in the compressed-air circuit.

#### 2. Preparations for the seal test

The injection pump is to be drained of all calibration and lubricating oil before testing starts. All openings in the pump are to be closed-off, with the exception of the connection port for the delivery-valve holder. Suitable plugs are to be used for the oil-outlet ports in the drive-side bearing end plate. Remove the Robo diaphragms.

#### 3. Seal testing

The seal test is applied to two areas of the pump:

- Suction gallery
- Camshaft chamber and spring chamber of the pump, and governor interior

Before submerging the pump in calibration oil, it is to be connected to the workshop compressed-air supply by means of a pressure-reducing valve with water separator. Fit the directional-control valve KDJE-P100/1 from the pressure-measurement device KDJE-P100 in the compressed-air inlet in order to carry out the specified pressure reduction during the leakage tests (Fig.). Now submerge the pump vertically in the test tank. The openings of the delivery-valve holder must not be covered with oil. Only rock the pump back and forth if it is necessary to localise the leak.

**BOSCH**

Geschäftsbereich KH, Kundendienst, Kfz-Ausstattung  
© by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50. Printed in the Federal Republic of Germany.  
Imprime en République Fédérale d'Allemagne par Robert Bosch GmbH.

**N4**

Technical Bulletins

P-pump 0 410 ..



### Suction gallery

Testing duration and testing pressure:

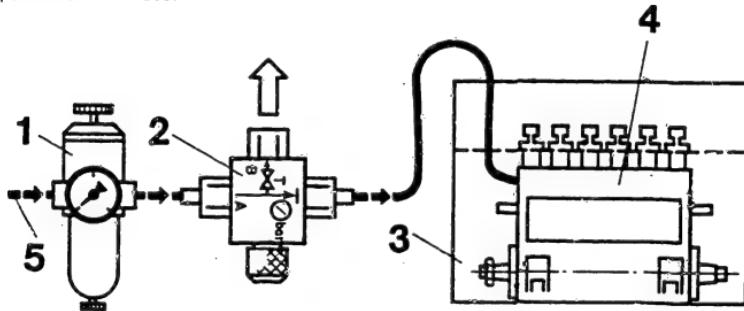
M- and A-pumps	4 minutes at 5 bar
MW-pumps	4 minutes at 5 bar, followed by 1 minute pulsation between 0 and 5 bar
P-pumps	8 minutes at 5 bar, followed by 1 minute pulsation between 0 and 5 bar
ZW(M) and CW-pumps	15 minutes at 5 bar.

### Explanatory notes:

When seal-testing the M-, A-, and CW-pumps, increase the pressure once starting at 5 bar and then search for leaks.

When seal-testing the MW- and P-pumps, after 4 minutes have elapsed (8 minutes with the MW-pump) the pressure must be pulsed continuously between 0 and 5 bar for a period of 1 minute. This is due to the differences in the type of seals used. For the test, apply the appropriate pressure to the suction gallery of the pump by means of the directional-control valve KDJE-P 100/1 and two matching hoses.

The pulsating pressure is achieved by continuously opening and closing the screw plug for the vacant connection on the directional-control valve for a period of 1 minute.



1 = Pressure-reducing valve with pressure gauge 0...6 bar and water separator

2 = Directional-control valve KDJE-P 100/1

3 = Submersion tank containing calibration oil

4 = Fuel-injection pump

5 = Compressed air

Leaks are not permitted in the suction-gallery area. Particular attention is to be paid to the plunger-and-barrel assembly seats, and the O-ring seals, not leaking. The only exception are leaks between the plunger-and-barrel assembly cylinder and the plunger.



Camshaft chamber and spring chamber of the pump, and interior of the governor

The compressed air required for the seal tests is to be applied at a suitable point (e.g. oil-level check bore) to the pump camshaft chamber.

Test duration and test pressure:

M-, MW-, and A-pumps	3 minutes at 1.5 bar, followed by 1 minute at 0.5 bar
P-pumps	7 minutes at 1.5 bar, followed by 1 minute at 0.5 bar
ZW(M) and CW-pumps	30 minutes at 0.5 bar

Finally, a visual check is to be made that no leaks show at any of the sealing surfaces, screwed fittings, seal rings and closure capsules on the housing and end cover. No air bubbles must be visible.

In order to rule out the possibility of skin irritation, the personnel concerned with carrying out the test are to apply a skin-protection cream to their hands. After completion of the test, hands are to be washed with soap and water.



## Table of contents

<u>Section</u>	<u>Coordinates</u>
1. Special features	A 2
2. Test specifications	A 2
3. General information	A 8
4. Tools	A 10
5. Exploded view P-pump with flange bushing P-pump with flange-type plunger-and-barrel assy	A 14 A 16
6. Dismantling the injection pump	B 1
6.1 Removing the timing device	B 5
6.2 Removing the manifold-pressure compensator	B 8
6.3 Removing the supply pump	B 9
6.4 Mounting the tappet holder	B 13
6.4.1 Pumps without thread/without through thread in locating bore	B 13
6.4.2 Pumps with through thread in locating bore	B 14
6.5 Pulling off the drive coupling	B 18
6.6 Removing the shutoff device	B 19
6.7 Removing the governor housing	B 20
6.8 Removing the bearing end plate	B 20
6.9 Removing the camshaft	B 21
6.10 Removing the roller tappets	B 23
6.11. Removing the control rod	C 4
6.11.1 Removing the control rod on 10/12 cyl. pumps	C 5
6.12 Removing the flange-bushing plunger- and-barrel assembly	C 6
6.13 Dismantling the flange-bushing plunger- and-barrel assembly	C 8
6.14 Removing the flange-type plunger-and- barrel assembly (P..6000/P..7000)	C 10
6.15 Dismantling the flange-type plunger- and-barrel assembly	C 12



## Table of contents (continued)

<u>Section</u>	<u>Coordinates</u>
7. Cleaning the parts/safety regulations	C 14
8. Checking the individual components	C 15
9. Setting the spring preload on torque-control delivery valves	C 22
10. Assembling the barrel-and-valve assemblies	C 23
10.1 Assembling the flange-bushing plunger-and-barrel assembly	C 23
10.2 Assembling the flange-type plunger-and-barrel assembly	D 3
11. Replacing the camshaft bearing	D 6
11.1 Presetting the projection dimension of the camshaft	D 11
11.2 Establishing the projection dimension	D 15
12. Measuring and setting the axial clearance	D 17
12.1 Measuring the axial clearance	D 17
12.2 Setting the axial clearance	D 19
13. Assembling the injection pump	D 21
13.1 Explanation of mounting number in type designation	D 21
13.2 Notes on housing modifications	D 24
13.2.1 Housing modifications	D 24
13.2.2 Modifications to prestroke shims	E 2
13.2.3 Modifications to spacer ring and flange bushings	E 2
13.2.4 Modifications to threaded pin	E 4
13.3 Installing the flange-bushing plunger-and-barrel assembly	E 8
13.3.1 Inserting the lower O-ring	E 8
13.3.2 Inserting the flanger-bushing plunger-and-barrel assembly	E 9
13.4 Installing the flange-type plunger-and-barrel assembly	E 10
13.4.1 Inserting the lower O-ring	E 10
13.4.2 Inserting the flange-type plunger-and-barrel assembly	E 11
13.5 Leak test on suction gallery	E 12



## Table of contents (continued)

<u>Section</u>	<u>Coordinates</u>
13.6 Inserting the control rod guide screw	E 15
13.7 Installing the guide bushings and control rod	E 16
13.8 Inserting the control sleeves	E 19
13.9 Installing the pump plunger	E 21
13.10 Installing the roller tappet	E 22
13.10.1 Mounting with eccentric tappet holder KDEP 2910	E 22
13.10.2 Mounting with tappet holder KDEP 1041	E 23
13.11 Installing the camshaft	F 1
13.12 Removing the tappet holder	F 4
13.13 Leak test on camshaft spring chamber and governor interior	F 6
Technical Bulletins	N 1

© 1985 Robert Bosch GmbH  
Automotive Equipment - After-Sales Service  
Department for Technical Publications KH/VDT  
Postfach 50, D-7000 Stuttgart 1.

Published by: After-Sales Service Department for Training and Technology (KH/VSK). Press date: 1.1985.

Please direct questions and comments concerning the contents to our authorized representative in your country.

This publication is intended only for the Bosch After-Sales Service Organization, and may not be passed on to third parties without our consent.

Microfilmed in the Federal Republic of Germany.  
Microphotographi  en R  publique F  d'Allemagne.

